

ELECTRICAL CONSTRUCTION AND MAINTENANCE

FEBRUARY • 1949

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A M c G R A W - H I L L P U B L I C A T I O N

Where can you get a 63.4% annual return on a \$2877 investment?

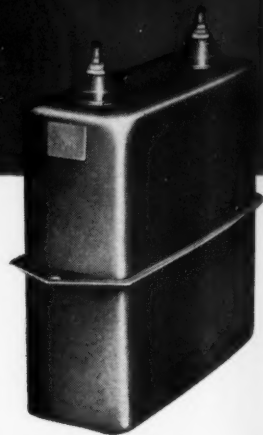
G-E capacitors are saving one Cleveland firm \$1824 a year—by maintaining a power factor of 99.5 per cent!

The case of the Cleveland plant of the Apex Smelting Company is startling—but typical. This plant installed 300 kvar of General Electric Pyranol® capacitors at a total cost of \$2877.39. By boosting the power factor and slashing power costs, the capacitors paid for themselves *in 19 months*—and continue to pay a handsome yearly return!

In all probability, your firm can make

similar savings. Even if you have no power-factor or kva demand clause in your power contract, capacitors will pay their way. They provide relief for overloaded feeder circuits and transformers—a 30% increase in capacity is not unusual. Or, if low voltage is slowing down production, capacitors may be your answer.

It will pay you to check. A G-E specialist will be glad to work with you or your engineering staff—to make sure your company takes full advantage of these remarkable savings.



A NEW BOOKLET explains how capacitors work and gives specific data to show you what you may expect from them. Write today for Bulletin GEA-5167. Apparatus Dept., General Electric, Schenectady 5, N. Y.

For other power distribution ideas that will save you money, ask your electric utility to show you the full-color slide-film, "Modern Industrial Power Distribution," or contact your G-E representative.

GENERAL  ELECTRIC

407-135A

"High,
wide"—yes,
and "handsome", too!

The ladder that
never
interrupts
production



Practically numberless working positions—many inclinations, height-variation foot by foot and full 360° rotation—all with practically automatic operation.

Crows' nests of varying heights, mounted on live skids, trailer bases, carriages, motor trucks or other suitable bases are doing important up-in-the-air jobs—indoors and outdoors—speedily, efficiently, safely. Fluorescent lights mounted over machines or benches are serviced without interrupting production.

Crows' nests are mighty useful, too, for inspecting, building, servicing and repairing planes in nearly every manufacturing plant and at airport after airport. For proposal, specify working height, sideways-reach and aisle-width.

Murray Crows' nest

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AMERICA'S
No. 1
MAINTENANCE
LADDER—for
indoors and outdoors**

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technical data

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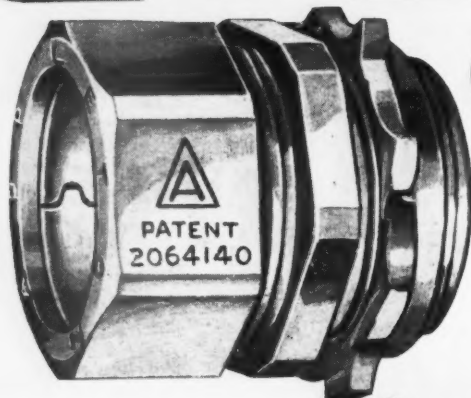
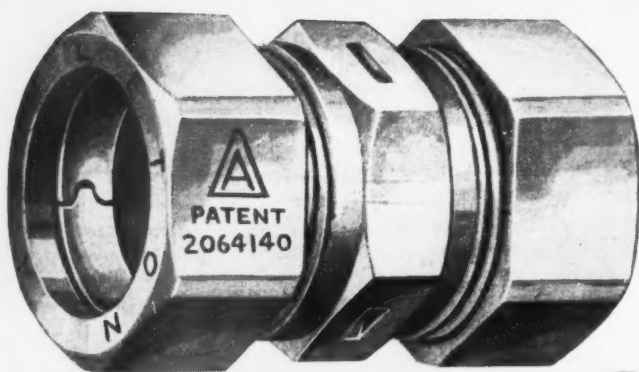
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*Immediate
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FOR ELECTRICAL METALLIC TUBING



ALL SIZES UNDERWRITERS' APPROVED

Appleton leadership in couplings and connectors is maintained by highest possible precision standards. All sizes now are Underwriters' Laboratories approved rain-tight and concrete-tight.

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Like all of the 15,000 fittings in the COMPLETE APPLETON LINE, Appleton Couplings and Connectors are "STANDARD FOR BETTER WIRING!"

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated *Electrical Contracting*,
The Electricist and Electrical Record . . . Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

February • 1949

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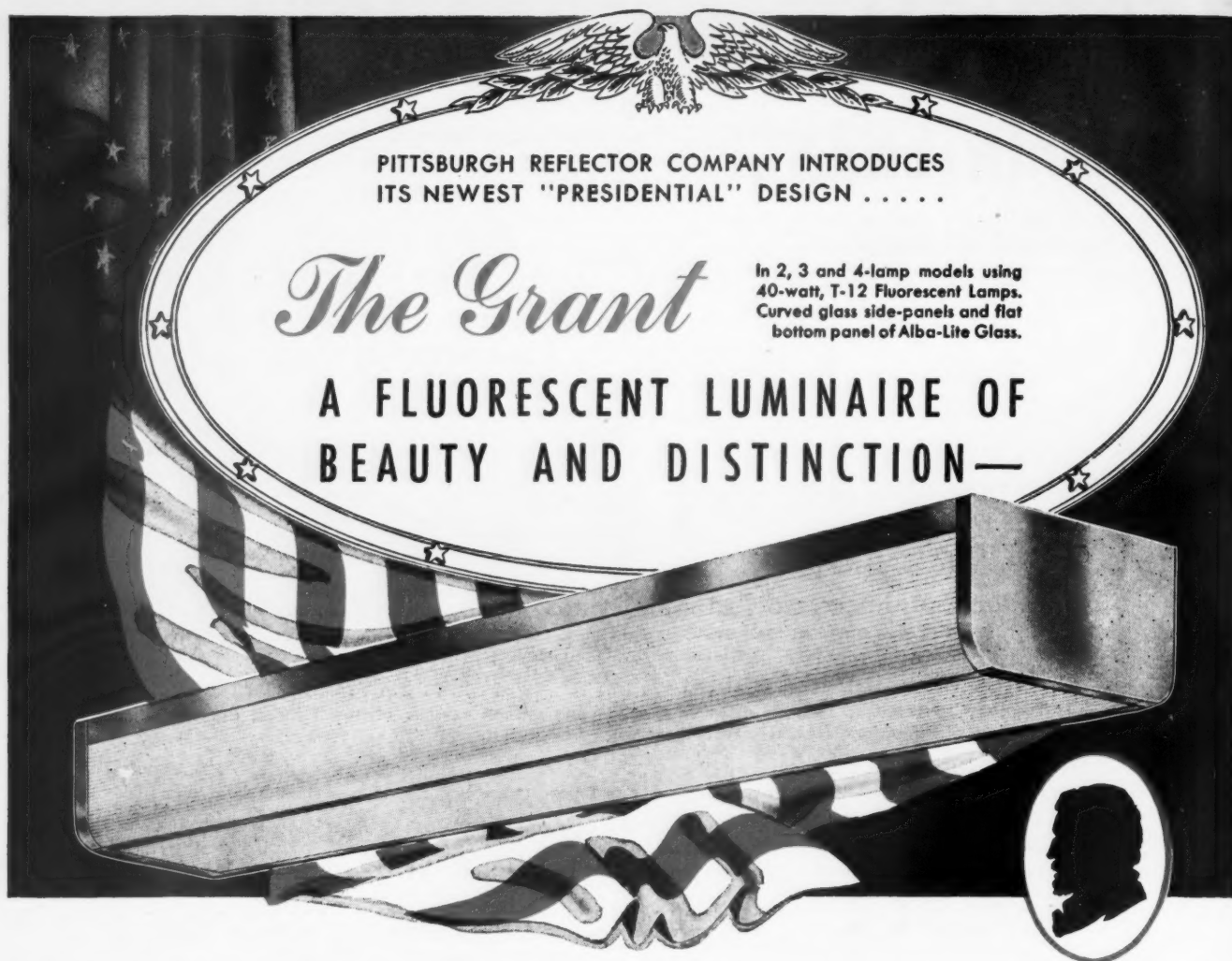
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TO ACHIEVE CUSTOM LIGHTING
RESULTS WITH STANDARD
EQUIPMENT**

Clear, concise and up-to-date—Catalog 48-F gives specifications, illumination values, descriptions, uses, application suggestions and other pertinent data on Pittsburgh Permaflexor Fluorescent Equipment and Companion Incandescent Equipment.

Write on your letterhead for Catalog 48-F.



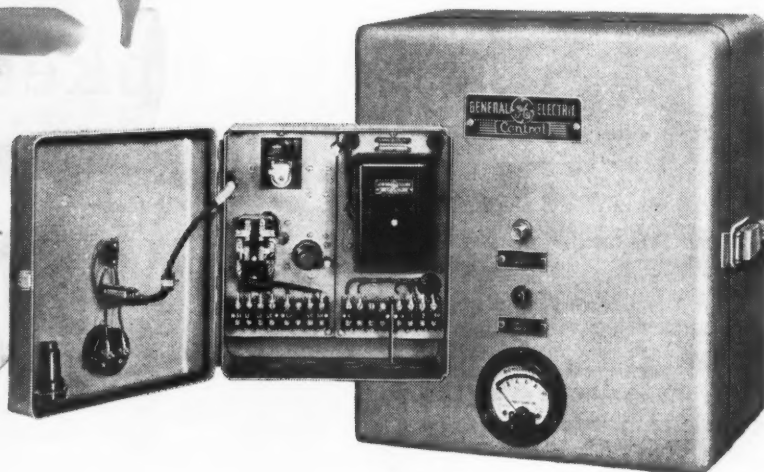
Pittsburgh Reflector Company

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BRAIN...

for commercial OIL BURNERS



**New G-E control
provides "double-check"
protection against:**

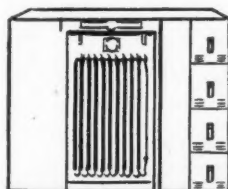
**PILOT FAILURE FLAME FAILURE
POWER FAILURE CARBONIZING
COLD-OIL STARTING**

COMPLETE OIL-BURNER PROTECTION . . . that's what you get when you specify General Electric's new photoelectric combustion control. It's a complete, co-ordinated system including master control unit, photo-tube holder and electrode holder. Assures positive protection against combustion failure by immediate fuel cut-off. All components of the system are easily removable for inspection and test without disturbing connections. Write for Bulletin GEA-4779: "Photoelectric Combustion Control for Commercial Oil Burners."

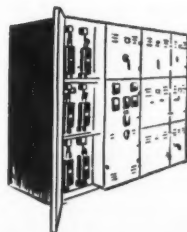
Development of this device is yet another proof that General Electric keeps abreast of commercial-building needs with complete electric equipment for all types of service: elevators, heating and ventilating, power distribution and conversion. Your nearest G-E sales office will have an application engineer help you plan your entire electrical system. **Apparatus Dept., General Electric Company, Schenectady 5, N. Y.**



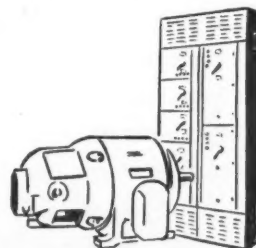
EQUIPMENT FOR COMMERCIAL BUILDING



Power-distribution systems



Rectifiers for Power Conversion

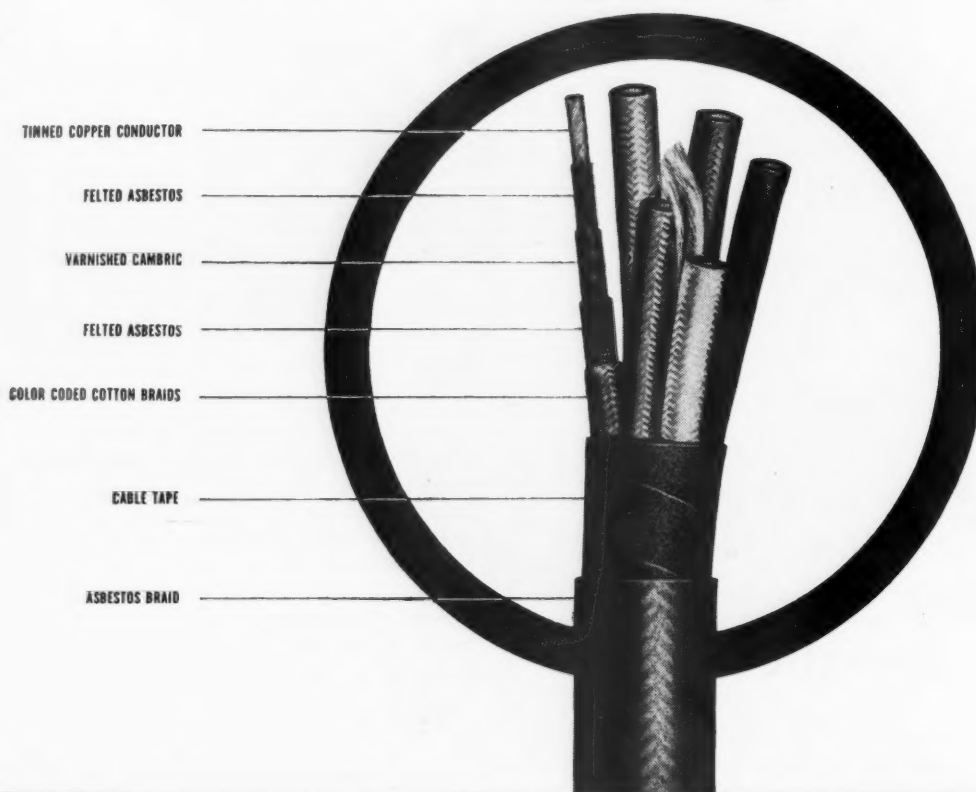


Motors and Control

GENERAL  ELECTRIC

665-103

This Just Goes to Show...
with cable, it isn't the cost
—it's the upkeep!



An Eastern Electric Utility used single conductor ROCKBESTOS AVC Wires and Cables for years.

But for "economy" they had been using ordinary low temperature control cable in their generating stations on vital control circuits to main steam boilers — burner tilt mechanisms and main power valves.

These circuits are close to steam lines — where it's hot! *Ordinary* control cables didn't stand up.

Convinced that ROCKBESTOS AVC... *Asbestos-Varnished-Cambric* . . . Permanent Insulation pays for itself in longer life, less

maintenance and fewer outages, the Company has now replaced the ordinary control cable in this hot spot with ROCKBESTOS Table MD AVC Control Cable.

It will pay *YOU* to know the ROCKBESTOS story! Write.

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WIRES and CABLES by

ROCKBESTOS

....dare to be better

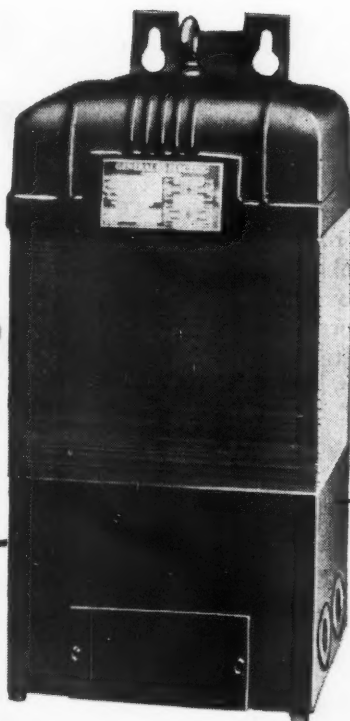
Spot power can save you plenty



Spot power means serving loads—600 volts and below—at the load, directly from power circuits. It means lower line losses, reduced copper costs, and consequently, higher installation efficiency and lower power costs.

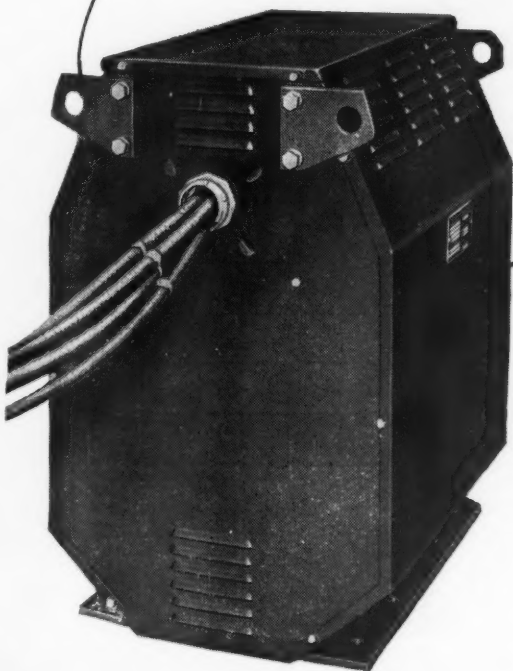
General Electric M & D dry-type transformers supply this power where you want it. Easily and quickly installed, they are quiet in operation and good for a lifetime of reliable service. Practically no inspection or maintenance is necessary.

All M & D ratings are available for quick delivery—many standard ratings from stock. See your local distributor or the nearest G-E Apparatus Sales Office. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



TYPE M

... for requirements calling for 0.25 to 10 kva ratings. Versatile Type M units perform equally well indoors or out—for lighting, phase changing or general power needs—or for 32-volt lighting circuits in standard ratings.



TYPE D

... for ratings of 15 kva and up. Type D's will give long-lived indoor service for phase changing and all general power and lighting applications.

GENERAL  ELECTRIC

411-38

NOW ... PROVED BY 12-MONTH

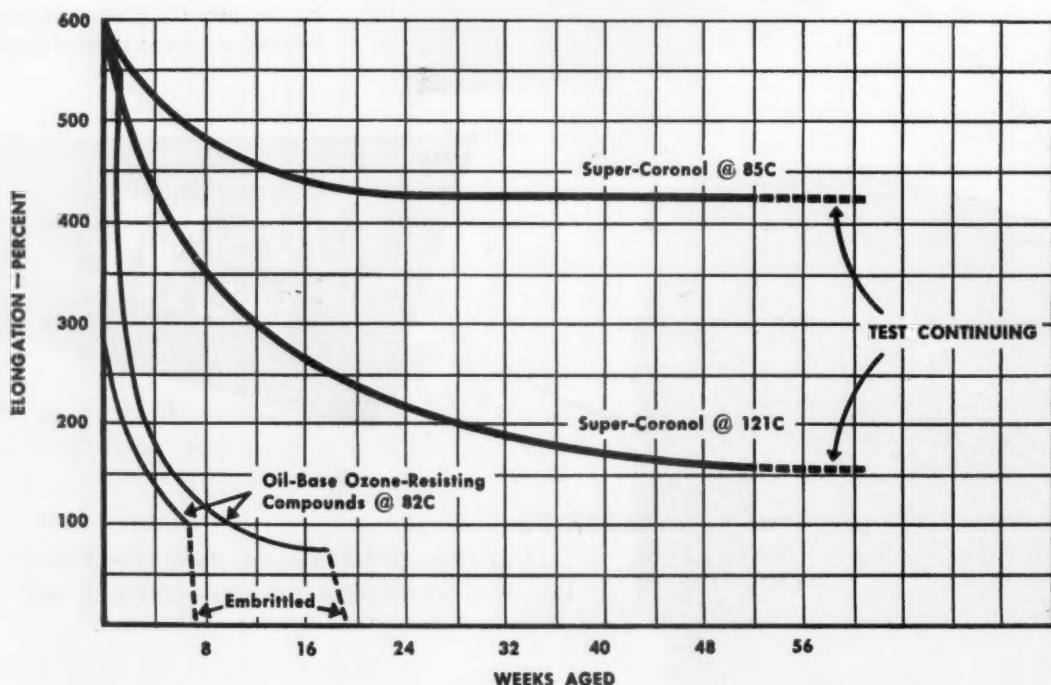
CORONOL-GEOPRENE

outlasts other cables 3 to 1
at higher temperatures!

Here's additional proof of the superior aging properties of Coronol-Geoprene, General Electric's rubber-type high-voltage power cable. Aging tests now covering a full 12-month period—and still continuing—prove beyond doubt that its Super Coronol insulation stands up at higher operating temperatures where other cable insulations fail.

Note the story told by the curves on the chart. At 85 C and 121 C, Super Coronol's special butyl-base compound lasts longer than other oil-base compounds at 82 C—at least three times longer! In addition, it provides an ample margin of safety over its recommended 80 C rating.

LIFE TEST OF RUBBER INSULATIONS



In this test, other insulations gave out at 82 C after 7 and 19 weeks. At 85 C and 121 C, Super Coronol insulation was still going strong after a full year. Even at its higher temperatures, Super Coronol's life was three times longer!

AGING TESTS: CABLE



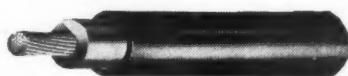
BOOSTS LOAD CAPACITY

Coronol-Geoprene is the only known rubber-type cable unreservedly recommended for 80 C operation up to 15 kv. That means you get higher current-carrying capacity in the same cable size, or reduced cable weight and cost through use of smaller sizes. And its excellent resistance to corona and ozone, to moisture and heat, make it ideal for all high-voltage applications.

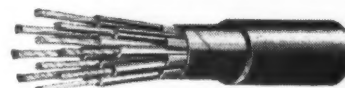
TOUGH—BUT HANDLES EASILY

Moreover, the Geoprene outer jacket on this G-E cable is more than twice as tough as the best prewar natural rubber jackets. Yet it's lighter, more flexible, and easier to handle than metal-clad cables, saving installation time and cost. For more data, send for Bulletin GEA-1788, "Some Facts About Super Coronol." *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

CORONOL®-GEOPRENE is one of six modern cables mass produced and authorized for warehouse stock. Standard designs permit quicker delivery and a lower price than special types. Each offers advantages in its recommended applications.



VERSATOL®-GEOPRENE For low-voltage distribution and branch-circuit wiring to motors and controls. Resists wear and heat aging. Bulletin GEA-4848.



FLAMENOL® For low-voltage wiring. Its chemically inert insulation resists water, cutting oils, acids, and alkalis, and is flame resistant. Bulletin GEA-4352.



VARNISHED-CAMBRIC LEADED For high-voltage feeders, distribution in underground ducts. Ideal for heavy loads in wet locations. Bulletin GEA-2623.



GEOPRENE PORTABLE For power to portable shovels, pumps, construction machinery, where resistance to rough handling and excessive flexing is needed. Bulletin GEA-4229.



INTERLOCKED-ARMOR For overhead power distribution throughout the plant. Needs no conduit, speeds installation. Bulletin GEA-4507.

GENERAL  **ELECTRIC**

508-98

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WHEN you install rigid conduit, you naturally want it to afford maximum protection for the wiring system you are installing. That's why more contractors buy Buckeye than any other kind.

Youngstown Buckeye is a full-weight, rigid steel conduit. It bends easily with any ordinary hickey, with no flattening at the radius. Its mirror-smooth enamel lining is non-conductive, tough and elastic, does not chip or break under shock or bending. It affords the protection you pay for when you buy rigid steel conduit.



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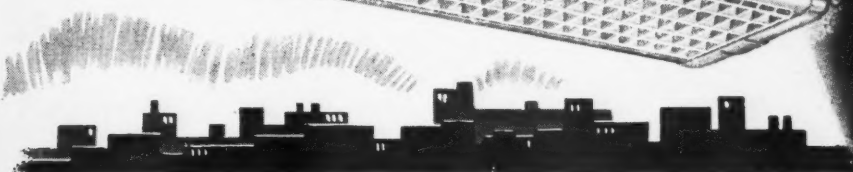
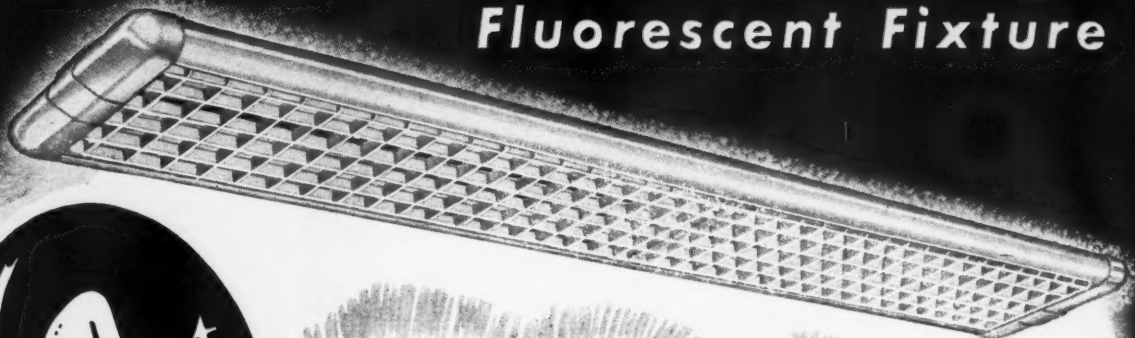
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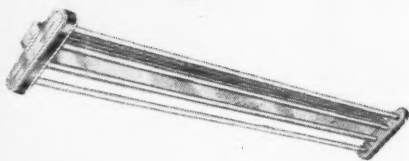
Leader

NEW HORIZON

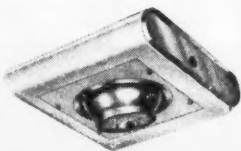
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Another Leader First!



Leader NEW HORIZON Open Type Fixture, especially designed for mass lighting of large commercial establishments.



The NEW HORIZON Incandescent Spotlight. Excellent for highlighting displays. Available for corner or center installations.



FIRST successfully-engineered, fully-proven, Slimline-tube lighting fixture.



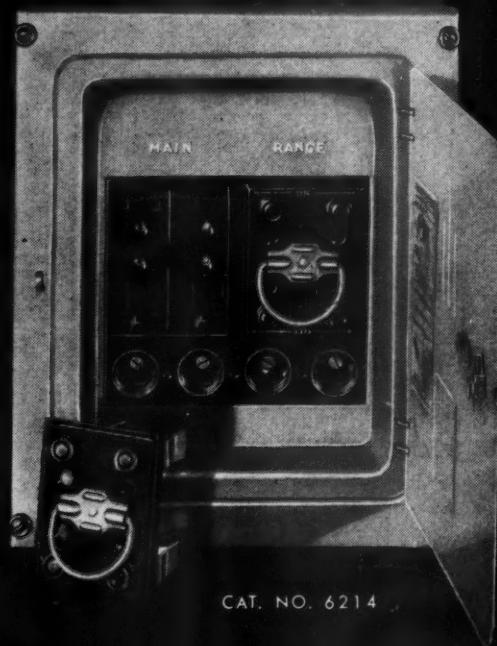
FIRST on the drafting board; first into production; first into the testing laboratory; and first on the market!



FIRST in a beautiful fixture ensemble of gleaming metal and plastic. First to achieve this practical result: Maximum diffusion of horizontally-directed light; muffled glare with a minimum of light interference.

NEW HORIZON, Model NHC-480 (as illustrated above) has drawn aluminum end-caps. Newly-designed, destaticized moulded-PLASTIC lightweight louvers (will not warp or discolor). Fully guaranteed. New-style tubular-PLASTIC translucent side panels . . . Slimline (instant-start) tubes designed for four eight-foot tubes: F96-T-8. Also for two eight-foot tubes: NHC-280.

The switch is to
GENERAL



CAT. NO. 6214

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 BRANCH-CIRCUIT OR RESIDENCE PANELS • PANELBOARDS FOR
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Cuts Your Down Time

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CHARLESTON ELECTRIC is a typical Allis-Chalmers Certified Service shop... the kind that is located in every major industrial center.

Yes, you can cut lost production time to the bone... get fast, expert service on motors, transformers and control by call-

ing the authorized A-C Certified Service shop in your area whenever you need help.

A-C Certified Service Shops are hand picked from the best independent shops in industrial areas. Each meets exacting Allis-Chalmers standards for experience, highly skilled workmen, modern equipment and reputation for square dealing. Each uses nothing but factory approved methods and parts.

Ask Your A-C Dealer or Office—Most industrial areas are now served by A-C Certified Service Shops. For expert service — or for new motors from 1/2 to 25,000 hp — see your A-C Authorized Dealer or District Office.

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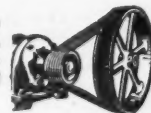
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 Applied . . .
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MOTORS — 1/2 to 25,000 HP and up. Matching Allis-Chalmers Control.

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PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

ALLIS-CHALMERS





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It's the Wire Stripper We've All
Been Waiting For!

THE NEW **IDEAL**

Stripmaster

(U.S. Pat. Applied For)

EASIER TO USE AND FASTER . . . WEIGHS ONLY 10 OZ. . .
OPERATES WITH A LIGHT SQUEEZE . . . HAS EXCLUSIVE AND
REVOLUTIONARY "AUTOMATIC" FEATURE . . . STRIPS SOLID OR
STRANDED WIRE

ONE SQUEEZE OPERATION

\$4⁸⁰

FIVE MODELS
Handle All Wire
Gauges—8 to 22

New in design—new in performance! The precision-built, pocket-size IDEAL Stripmaster makes wire stripping easier than ever before. There's no other hand-type stripper even remotely like it! . . . One light-pressure squeeze strips wire clean and bare up to $\frac{7}{8}$ inch. Exclusive "automatic" feature that holds jaws open while wire is removed positively eliminates crushing of stranded wire. No waste—no nicked or frayed wire—no cut fingers.

Just squeeze the handles to strip; release your grip and remove the wire. The jaws then *snap* back, ready for the next strip. Takes less than 3 seconds.

So light (10 oz.) and compact even a girl can use it all day long without fatigue—so strong and simple as to be practically abuse-proof. Blade is hardened and ground for extra long life—when necessary can be changed in a jiffy.



THE PERFECT WIRE STRIPPER FOR:

Electricians • Radio Repair Men
Ignition Experts • Maintenance Men • Mechanics • Electrical Manufacturers (Use the Stripmaster right on the assembly line)

STRIPS ANY OF THESE TYPES OF WIRE

Building Wire Telephone Wire
Fixture Wire Aviation Wire
Lamp and Appliance Cords
(individual conductors)
Automotive Wiring
Radio and Instrument
Wire and Cable
Switchboard Wire
FM and TV Down Lead Wire

JUST INSERT
WIRE, SQUEEZE
AND RELEASE!



- (1) Insert wire between jaws and hold in proper stripping hole;
- (2) Squeeze handle to cut insulation and strip;
- (3) Release handle and remove wire. Jaws immediately snap back into position.

OTHER IDEAL PRODUCTS THAT MAKE EVERY WIRING JOB EASIER AND FASTER

IDEAL



Simplest, Best
Way to Make
Approved
Wire Joints

Wire Nuts
Patented—No. 1,713,501
(THE SOLID-STATE, TAPLESS WIRE CONNECTOR)

FASTER, BETTER wire joints at lower cost! Just screw on—like a nut on a bolt. No solder, tape or tools. For all common wire joints, solid or stranded. Millions in use. Listed by Underwriters' Lab., Inc.

NEW B-X ARMOR CUTTER



Easiest Way to Cut B-X

Just snip, twist BX and pull it apart. Cuts two or three No. 10, 12 or 14 cable armor, large or small diameter. Blade removable for sharpening. Cuts anywhere along length of cable.

FISH TAPE, REEL AND PULLER

3 tools in 1. Gives big pull and sure grip that makes it easy to bring tape through conduit easily. Keeps tape always under control, free of kinks or bends. Prevents springing or breaking. Workmen avoid "live" parts. Cuts fishing time 50%. Five sizes.



Distributed through America's Leading Wholesalers

IDEAL INDUSTRIES, Inc., Sycamore, Illinois

MITCHELL-RAND

announces....

Flexite HITEMP

The flexible, extruded plastic tubing . . .
to withstand high temperatures above **105° C**

FLEXITE HITEMP is the electrical insulation tubing that sets new standards for resistance to extreme high temperatures. Compounded of a plasticized copolymer of vinyl chloride and vinyl acetate and manufactured with a true wall thickness, smooth inside and outside FLEXITE HITEMP PLASTIC TUBINGS offer the greatest resistance to high and low temperatures, are extremely flexible and have great tensile strength.

Other significant properties of FLEXITE HITEMP compare more than favorably with tubings of similar nature. Check the specifications of HITEMP, compare them with the requirements for your products and if you wish against other insulations for identical use . . . HITEMP sets a new high standard for protection against high temperatures, high dielectric, stretching, tearing, abrasion, exposure to acids, oils and alkalis, flammability, etc., etc., etc. — . . . samples and additional information will be sent upon request.

FLEXITE HITEMP PHYSICAL & ELECTRICAL PROPERTIES

- a—tensile strength, minimum average 2500 PSI
 - b—ultimate elongation, minimum average 300%
 - c—dielectric strength, minimum 800 v/mil
 - d—flammability non-inflammable
 - e—heat resistance—after 100 hours at 300° F. the tubing is not brittle and when flexed does not crack.
 - f—heat endurance—recommended for continuous operating temperatures up to 105° C., and when baked at 125° C. for 2,000 hours does not become brittle.
 - g—low temperature flexibility —30° C.
 - h—heat shrinkage ASTM Standards
 - #20 — #17 incl. — less than 8%
 - #16 — # 6 incl. — less than 5%
 - # 5 and larger — less than 3%
 - i—oil resistance—highly resistant to effects of transformer and lubricating oils, does not stiffen when continuously exposed to them.
- Colors**—black, white, red, green, yellow and blue are standard colors.
- Dimensions and Tolerances**—standard sizes to fit B & S wires #20 to #0 inclusive, as specified by ASTM Spec. D922-47T.
- Wall Thickness**—in accordance with ASTM Spec. D922-47T, as follows:
 #20 — #10 incl. — .016" ± .003"
 # 9 — # 0 incl. — .020" ± .003"
- Standard Lengths**—Standard 36" lengths or continuous lengths in coils. Sizes #20 — #10 incl., will be supplied on paperboard spools when so ordered.
- Quality**—uniform in quality and condition, smooth on both inside and outside, free of defects such as pin-holes, blisters, foreign inclusions and other imperfections.
- Test Methods**—properties enumerated in above specifications shall be determined according to Tentative Methods of Testing Nonrigid Polyvinyl Tubing, American Society for Testing Materials, Designation D876-46T.

M-R THE
ELECTRICAL
INSULATION
HEADQUARTERS
FOR 59 YEARS



And for a Plastic Tubing to Withstand Normal High Temperatures
Mitchell-Rand Offers . . . Flexite-Norm . . . write for specifications.

MITCHELL-RAND INSULATION CO. Inc.

51 MURRAY STREET • Cortlandt 7-9264 • NEW YORK 7, N. Y.

A PARTIAL LIST OF M-R PRODUCTS: FIBERGLAS VARNISHED TUBING, TAPE AND CLOTH • INSULATING PAPERS AND TWINES • CABLE FILLING AND POTHEAD COMPOUNDS • FRICTION TAPE AND SPLICE • TRANSFORMER COMPOUNDS • FIBERGLAS SATURATED SLEEVING • ASBESTOS SLEEVING AND TAPE • VARNISHED CAMBRIC CLOTH AND TAPE • MICA PLATE, TAPE, PAPER, CLOTH, TUBING • FIBERGLAS BRAIDED SLEEVING • COTTON TAPES, WEBBINGS AND SLEEVINGS • IMPREGNATED VARNISH TUBING • INSULATED VARNISHES OF ALL TYPES • EXTRUDED PLASTIC TUBING

This Handy Selection Chart

Answers the Question...



"What Speed Measuring Instrument Shall I Use?"

The quick-reference selection chart and index, illustrated above, tells you at a glance which type of Biddle instrument to use for your particular speed measuring problem. This handy guide is but one of many helpful features found in a newly-published bulletin, which contains descriptions, illustrations, and other data on our resonant-reed, chronometric, and centrifugal types of high quality speed measuring instruments. We would be pleased to send you a *free* copy of this new Biddle bulletin with selector chart. Your request will bring it to you promptly. Simply ask for Bulletin 35-EC.

JAMES G. BIDDLE CO.

Electrical & Scientific Instruments

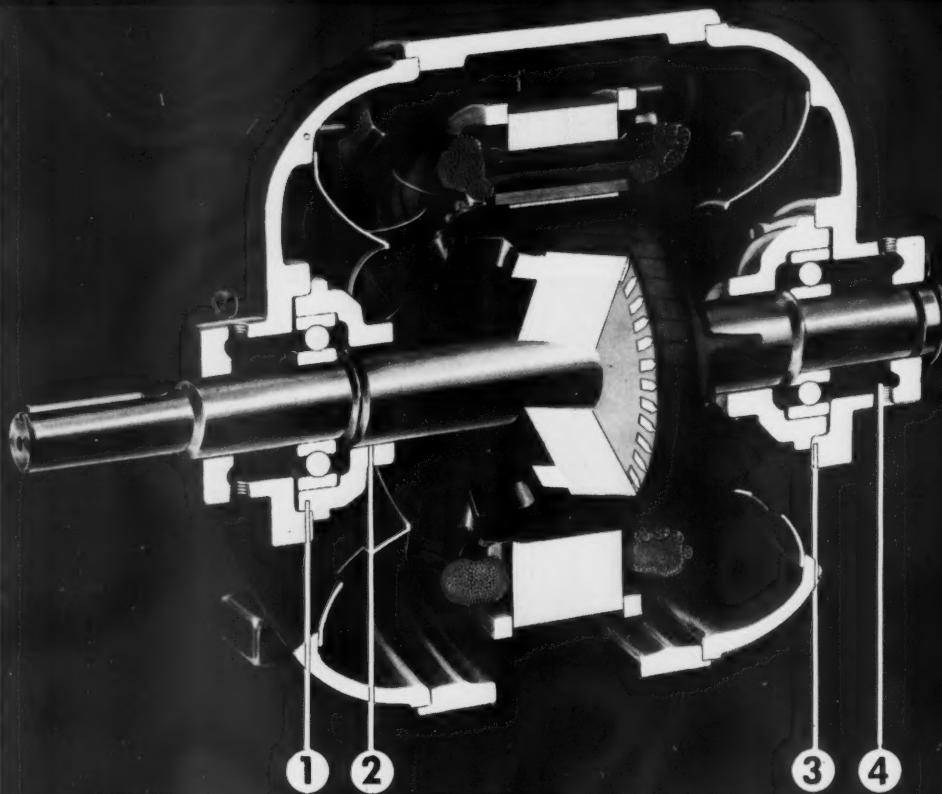
1316 ARCH STREET, PHILADELPHIA 7, PA.

A black and white photograph of a GE Tri-Clad motor. A large spider web is draped over the top right portion of the motor, symbolizing long-term maintenance-free operation. The GE logo is visible on the motor's frame.

**YOU CAN'T BEAT A
TRI CLAD MOTOR FOR
EASY MAINTENANCE**

GENERAL  ELECTRIC

HERE'S
WHY



Notice (1) how Tri-Clad bearings are surrounded by and rigidly supported in solid cast-iron housings. Compare the long, close-running fit between housing and shaft (2) with other motor bearings. Examine the tight rabbet fit between inner cap and end shield (3) which keeps dust and moisture out and lubricant in. See, too, the pressure-relief greasing system (4) that makes it easy to lubricate if you need to.

You can't beat a **TRI-CLAD** motor for easy maintenance

A **TRI-CLAD MOTOR** will run safely without lubrication for years—for as long as any other general-purpose motor you can buy. The big thing is—it's *grease-gun easy* to lubricate a Tri-Clad if you need to.

You don't have to take a Tri-Clad motor down and disassemble the bearings to lubricate it. You don't have to follow special instructions. A standard gun and a good grease are all you need.

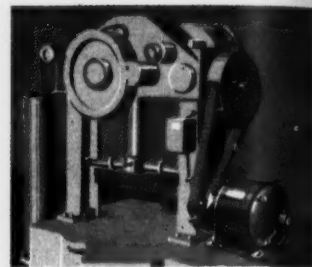
And remember, Tri-Clad gives you all the extra protection that only cast-iron structure can give . . . Extra protection against rust and corrosion . . . Extra protection against mechanical abuse and permanent distortion . . .

Extra protection that has been proved in more than 5 billion hours of rough-and-tumble industrial service.

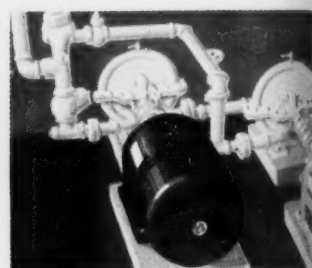
WANT TO SEE FOR YOURSELF? Tri-Clad motors in nearly all types and ratings are ready for **IMMEDIATE SHIPMENT**. Contact your nearest G-E Office or write Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL  **ELECTRIC**

There's a Tri-Clad motor for every industrial need!



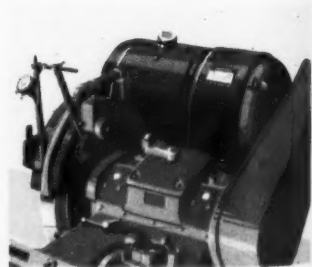
G-E open (dripproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for operation where dust or corrosive fumes are a hazard. From 1 to 1000 hp.



G-E capacitor motors for use on fans, blowers, pumps and compressors with single-phase power. From 3/4 to 5 hp.



G-E Type ACA induction motors for adjustable speeds—provide 3 to 1 speed range. From 3 to 200 hp.

YOU CAN'T BEAT
TRI-CLAD
REG. U.S. PAT. OFF.
EXTRA
PROTECTION



Burndy Qik Connectors

. . . a family of connectors designed for quick, high strength connections—including QIKLUG, QIKLINK, and QIKTAP illustrated; as well as many variations for special applications. Unit assembly of the lug and link permits connecting without taking apart . . . each connector accommodates a range of sizes. Compactness and rounded edges make taping easy. Installed with ordinary wrench. Available for conductors from #14 Sol. to 2000 Mcm. Ask for catalog describing the complete Qik-line, and showing why it pays to

Connect with
BURNDY

New York 54, N. Y.

WESTERN BRANCH: Vernon 11, California • CANADA: Canadian Line Materials, Ltd., Toronto 13

FOREIGN: Philips Export Corp., New York 17, N. Y.

Announcing

NEMA Sizes 0, 1, 2, 3
for a-c motors
up to 50 hp



GENERAL  ELECTRIC

Here
of G-
start
faste
easy
can f

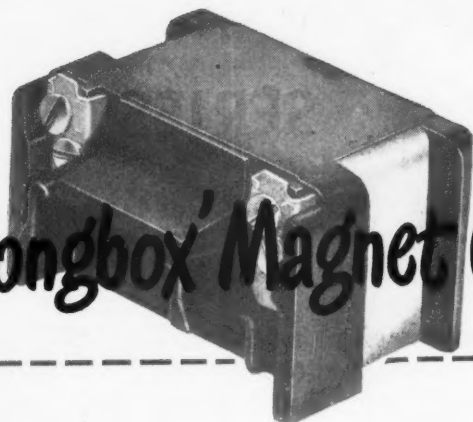
a complete NEW line



MOTOR STARTERS

with the

'Strongbox' Magnet Coil



Here it is—a completely new line of G-E motor starters—full-voltage starters made for extra-long life, faster installation. Designed for easy maintenance, but built so you can forget them.

NEMA Sizes 0, 1, 2, and 3—each size new all the way through. Everything's new—contacts, arc hood, magnet, armature, and the tough Strongbox magnet coil. Get your first G-E starter and compare!

**SO NEW
SO DIFFERENT
YOU CAN'T AFFORD TO WAIT
ORDER TODAY!**

General Electric Company
Apparatus Dept.
Sec. Q676-277
Schenectady 5, N. Y.

Please send me your bulletins describing the new a-c motor starters:

GEA-5153 (CR7006 A-c Magnetic Starter) _____

GEA-5156 (CR7008 A-c Combination Starter) _____

Name _____

Company _____

Address _____

**all
new
all
the
way
thru**

It's ONE to FIVE

FOR THE MOST SIMPLE
... MOST FLEXIBLE
FLUORESCENT LIGHTING

INSTALLATION



WIREMOLD 21A SERIES fluorescent UNITS

Smartly-designed, compact, ready-wired . . . Wiremold 21A Fluorescent Units are ideally suited to meet the lighting needs of a wide range of commercial and industrial applications. Available as single lamp units . . . or for two, three, four and five lamps.

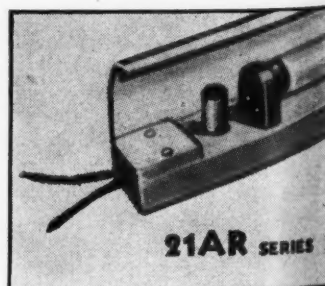
All units quickly, easily installed in horizontal or vertical position . . . clips furnished for permanent or portable mounting. Finished in sparkling white . . . may be used with or without reflectors. Ballast enclosed in channel.

No matter how simple or complex your problem . . . whether it's a matter of supplementary lighting or the installation of a complete system . . . check into the profit-building possibilities of Wiremold Fluorescent Units.

Today: write for complete information
THE WIREMOLD COMPANY
HARTFORD 10, CONN.

For use in . . .

WORKSHOPS
LABORATORIES
STORES
RESTAURANTS
GARAGES
OFFICES
FACTORIES



Similar to the 21A series . . . with single and multiple units . . . but equipped with reflectors and end caps. Finished in golden bronze. Ideal for showcases, counter displays, wall cases, display boards, etc.

STOCK ORDERS PROMPTLY FILLED

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . FEBRUARY, 1949



2-inch Type LBD
Condulet with three
No. 1 lead covered cables

A straight line
easy pull either way

Type LBD ... the straight line pull **CONDULET**

for large or lead covered electrical conductors.

(CONDULETS are made only by CROUSE-HINDS)

A straight line pull through EITHER hub.

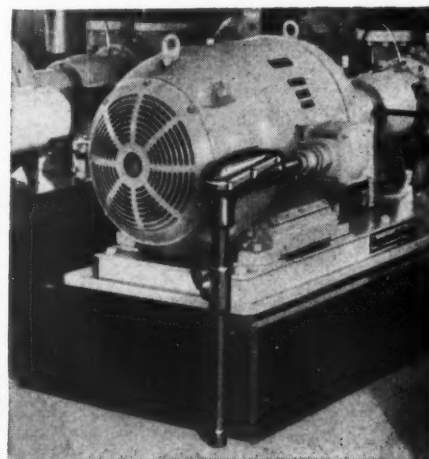
Saves time.

Unobstructed pulling space. Easy to manipulate
conductors.

Domed cover. Provides extra space to prevent sharp
bends that are likely to injure the con-
ductor insulation or sheath.

All sizes. For electrical conduit from
 $\frac{1}{2}$ -inch up to 6-inch.

**An Explosion-Proof type is
available.** Type LBH in sizes from
 $\frac{1}{2}$ -inch up to 3-inch.



CONDULETS ... first in the field and the finest



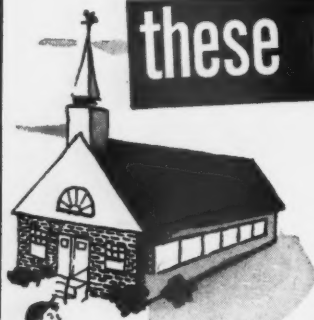
CROUSE-HINDS COMPANY Syracuse 1, N. Y., U.S.A.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York
Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. Resident Sales Engineers: Albany — Atlanta — Charlotte — Indianapolis — New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

CONDULETS • TRAFFIC SIGNALS • AIRPORT LIGHTING • FLOODLIGHTS

Only *Smithcraft Eye-Q* has

these outstanding *Selling* features



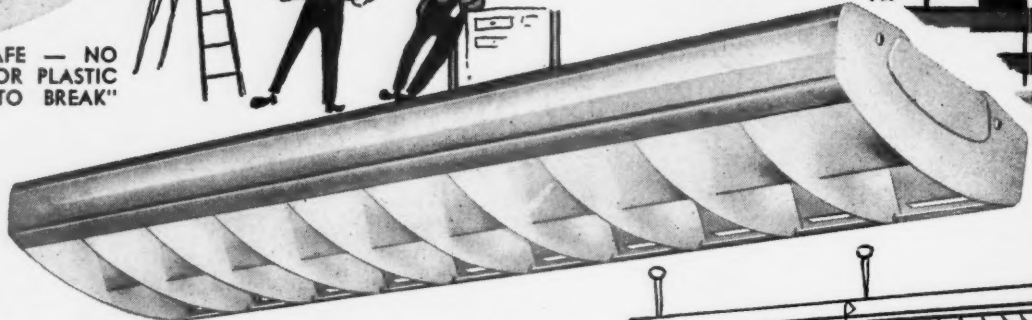
"IT'S SAFE — NO GLASS OR PLASTIC PARTS TO BREAK"



"IT'S SIMPLE TO INSTALL"

"IT'S SIMPLER TO CLEAN"

"LOUVERS HINGE FROM EITHER SIDE AND CAN BE COMPLETELY REMOVED"



"EXCEPTIONALLY HIGH EFFICIENCY — 83%. HIGH LIGHT OUTPUT WITH UNIFORM LOW BRIGHTNESS"



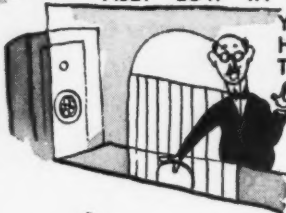
"THOSE LO-BRITE LOUVERS MINIMIZE GLARE FOR COOL, COMFORTABLE LIGHT"

"YOU'RE RIGHT, AND LOOK AT THE SMART STYLING AND DESIGN"



"EYE-Q IS UNBELIEVABLY LOW IN COST,"

"YET CONFORMS TO THE HIGHEST CONSTRUCTION STANDARDS"



"YOU KNOW EYE-Q CAN BE MOUNTED IN ANY NUMBER OF WAYS"

"RIGHT, AND EITHER INDIVIDUALLY OR IN CONTINUOUS ROWS"



Eye-Q, for 2 40-watt lamps, combines every essential factor from economy to efficiency that must be an integral part of the right fixture for schools, stores, offices and buildings. It is one of many Smithcraft Fluorescent units designed to meet your lighting requirements.

Smithcraft
LIGHTING DIVISION
CHELSEA 50, MASSACHUSETTS



TOPS

FOR DEPENDABILITY



**Roebling
Building Wire
and Cable**

CONTRACTORS SPECIFY ROEBLING YEAR AFTER YEAR

EXPERIENCE IS THE BEST TEACHER, and it's actual experience that leads so many contractors to standardize on Roebling Building Wire and Cable. They know, from long use and service records, the supreme reliability and economy of Roebling wire and

cable . . . make it their top specification.

For circuits to 600 volts and conductor operating temperatures to 60°C. (140°F.), Roebling Wire 60 Type R. is unsurpassed. It is synthetic rubber insulated; has a flame- and moisture-resistant fibrous covering; comes with solid

or stranded conductors . . . Of similar construction, Type RH permits conductor operating temperatures to 75°C. (167°F.), and Type RW is adapted for wet locations without lead sheath.

There's a Roebling wire or cable for every requirement . . . call or write your nearby Roebling Distributor. John A. Roebling's Sons Company, Trenton 2, New Jersey.

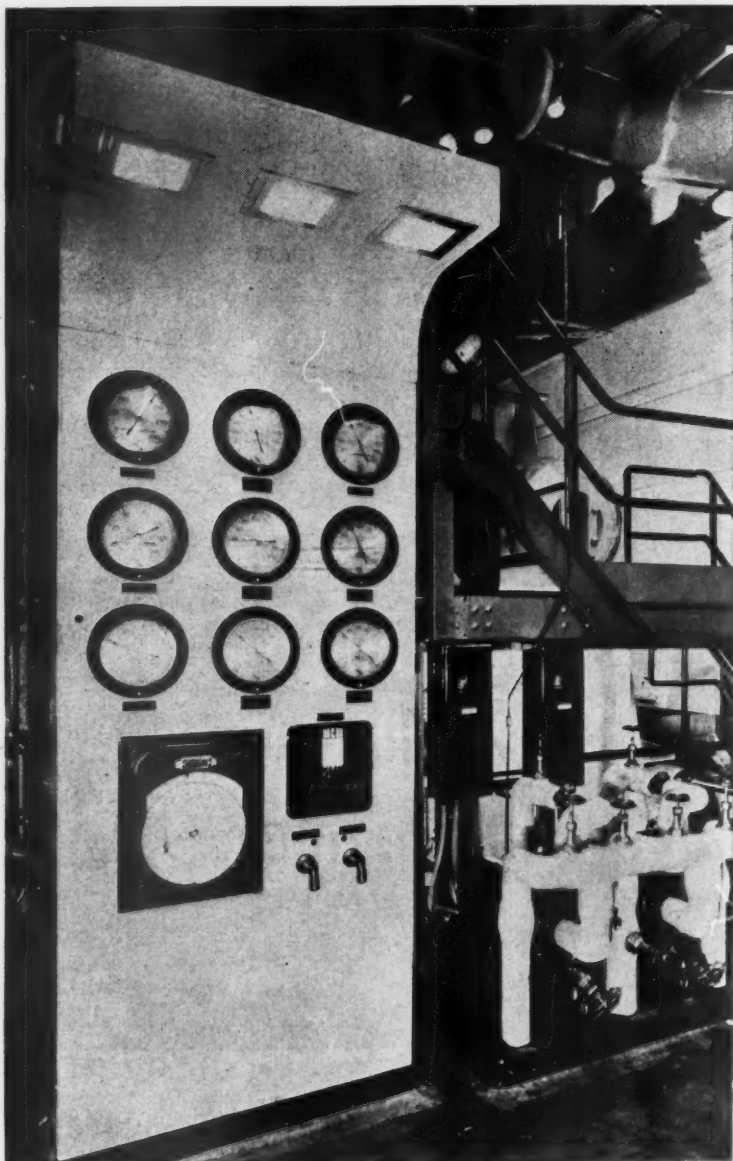
WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST
ROEBLING OFFICE AND WAREHOUSE

Atlanta, 934 Avon Ave. ★ Boston, 51 Sleeper St. ★ Chicago, 5525 W. Roosevelt Rd. ★ Cleveland, 701 St. Clair Ave., N. E. ★ Denver, 1635 17th St. ★ Houston, 6216 Navigation Blvd. ★ Los Angeles, 216 S. Alameda St. ★ New York, 19 Rector St. ★ Philadelphia, 12 S. 12th St. ★ Pittsburgh, 855 W. North Ave. ★ Portland, Ore., 1032 N. W. 14th Ave. ★ San Francisco, 1740 17th St. ★ Seattle, 900 First Ave.

ROEBLING

☆ A CENTURY OF CONFIDENCE ☆

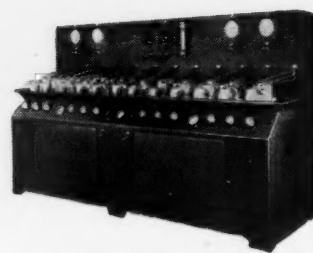
DO YOU HAVE AN ELECTRICAL HOUSING SHORTAGE?



Illustrated above, is a control panel installation, one of many KIRK & BLUM built units at Columbia Park, Ohio. Note the integral lighting canopy.



There's no problem in housing where electrical housings are involved. Electrical engineers in power production, distribution and use, rely on KIRK & BLUM "fabrication to order" for panelboards, switch gear housings, test stands, remote control boards and desks, cubicles and other needs. Your prints can be transformed into finished units . . . as you want them . . . and when you want them. A new booklet—"Sheet Metal Assemblies"—showing a wide range of fabricated units by Kirk & Blum is now available. Write for your copy. The Kirk & Blum Manufacturing Company, 2903 Spring Grove Ave., Cincinnati 25, Ohio.



KIRK AND BLUM
Make Your Blueprints
Come To Life

ALLIS-CHALMERS DRY TYPE TRANSFORMERS MAKE IT

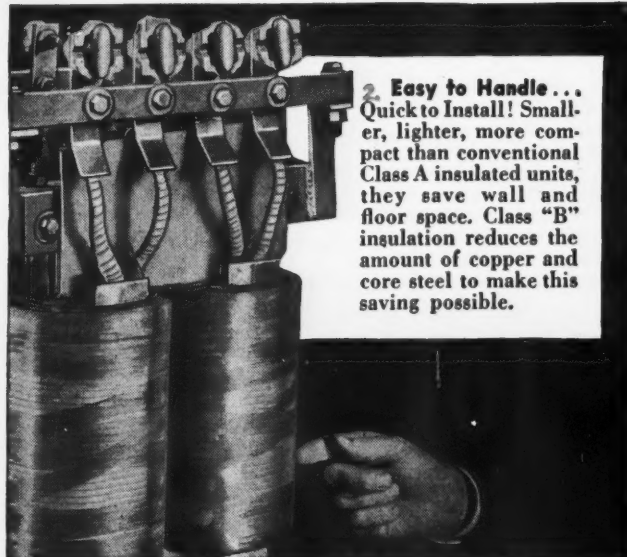
EASY

**to Put
Power Where
You Need it!**

A 2319



1. Time-Saving Solderless Clamp
Type Connectors are standard on single phase (BD) units 15 kva and larger, and on three phase (BDT) units 37½ kva and larger. Big, roomy wiring compartment, provided in all sizes helps reduce hook-up time to a minimum. In addition, these transformers are . . .



2. Easy to Handle . . .
Quick to Install! Smaller, lighter, more compact than conventional Class A insulated units, they save wall and floor space. Class "B" insulation reduces the amount of copper and core steel to make this saving possible.



3. This Completely Enclosed Unit, with suitable openings for ventilation, affords maximum safety. Surface is Sprabonderized to resist corrosion by acids . . . vapors . . . moisture. Three coats of paint are then separately baked-on.



4. Lifting Hooks project well out for easy hoisting. Units 37½ kva and larger are platform mounted. Smaller sizes are wall mounted. Your transformer is available in 14 sizes up to 500 kva . . . single and three phase units. See your nearby A-C dealer or representative, or write ALLIS-CHALMERS, MILWAUKEE 1, WIS.



ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products



OTHER ALLIS-CHALMERS TRANSFORMERS

| Instrument Transformers of all types. | Distribution Transformers 1½ to 500 kva. | Power Transformers from 500 kva to largest. | Load Center Transformers to 2000 kva. |
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| | | | |

DEPENDABLE *Protection*

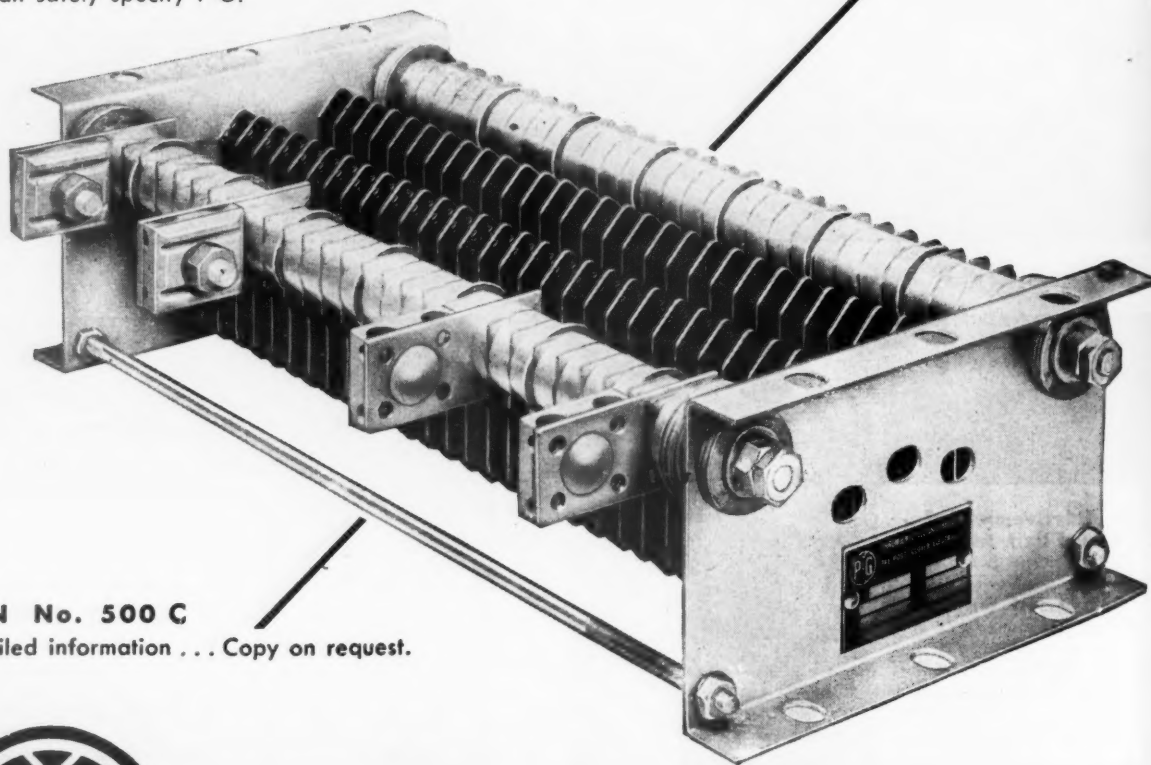
with **P-G** *Steel Grid Resistors*

Steel and Mica, with P-G design, create a resistor really able to protect electrical equipment, especially, where service requirements are severe.

P-G Steel Grid Resistors are sturdy, light in weight, and consistently dependable.

These resistors maintain unusually constant resistance values regardless of temperature or age.

Where "trouble-free" resistor service is essential . . . you can safely specify P-G.



BULLETIN No. 500 C

Gives detailed information . . . Copy on request.



The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO

You know you're right
with **"G-E White"**



clean, sharp-cut threads



uniformly high quality

Clean-cut threads and uniformly high quality are only two of several features that make General Electric white rigid conduit the first choice of electrical contractors and maintenance men everywhere. Other considerations are its *hot-dipped* zinc coating—fused into high-grade steel—and its tough, smooth-as-glass Glyptal* lacquer finish, inside and out.

Always, when you think of rigid conduit... think of "G-E White." For further information, see your nearest General Electric Construction Materials distributor, or write to Section C15-218, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

*Trade-mark Reg. U. S. Pat. Off.

GENERAL  ELECTRIC

RACEWAYS ROUNDUP

with your
GENERAL ELECTRIC
Construction Materials Distributor



Still the favorite for wiring protection against chemical corrosion is General Electric black rigid conduit.

"G-E Black" is made from the same high-grade steel—and is manufactured with the same precision—as "G-E White." The tough, glassy-smooth, baked-on enamel makes wire pulling easy, and is an excellent paint base.

General Electric switch and outlet boxes are made in a variety of sizes, shapes, and depths for every purpose.



Most are available either galvanized or with black-enamel finish. All cable and conduit boxes have improved knockouts, are easy to install, and have the approval of Underwriters' Laboratories, Inc.



General Electric fittings and accessories for the complete line of G-E conduit products are available.

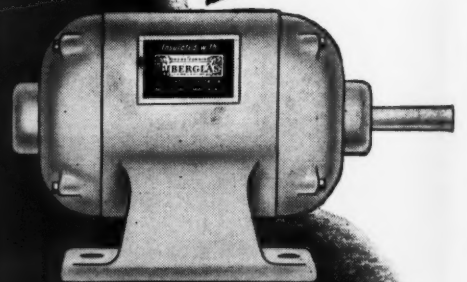
Carefully designed connectors, nipples, couplings, and other fittings make installation of G-E raceways simple and fast. All types of connectors for armored and nonmetallic cables are included in the G-E line. When installing any type of electric wiring, make sure you use General Electric fittings.

On your next order, why not try the time-saving, "one-stop, one package" service that your General Electric distributor can supply?

Because he carries the complete General Electric line, you can order every item you need from him. No need to run around getting part of your requirements in one place and part in another. It's the kind of service busy contractors need to help stretch scarce working hours.



**Conduit
Products**



SIGN... of performance PLUS

Do your motors operate under conditions of overload, heat, moisture? Are oil, dust, acids or corrosive vapors and fumes hazardous to motor operation in your plant? Interested in reducing motor failures—down time—rewind expense?

Then insist on Fiberglas*-base Electrical Insulating Materials on your next motor rewind. You'll find they have far higher resistance to these hazards than organic insulations . . . that they will save you time and money.

In or near your community, there are rewind experts skilled in the use of these highly

efficient electrical insulating materials. Their shops are identified as Approved Fiberglas Repair and Rewind Shops . . . the motors they rewind are identified by the label shown above. Thousands of users all over the country are getting more dependable performance from motors bearing this sign—the sign of *performance plus*. Check the classified section in your phone book or write us for names of the shops in or near your community where you can obtain this service. Owens-Corning Fiberglas Corporation, Dept. 856, Toledo 1, Ohio. Branches in principal cities.

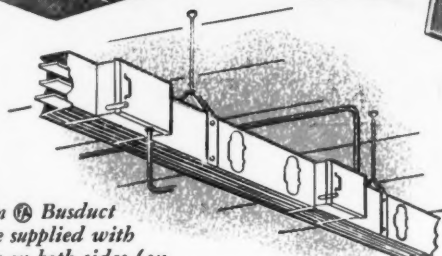
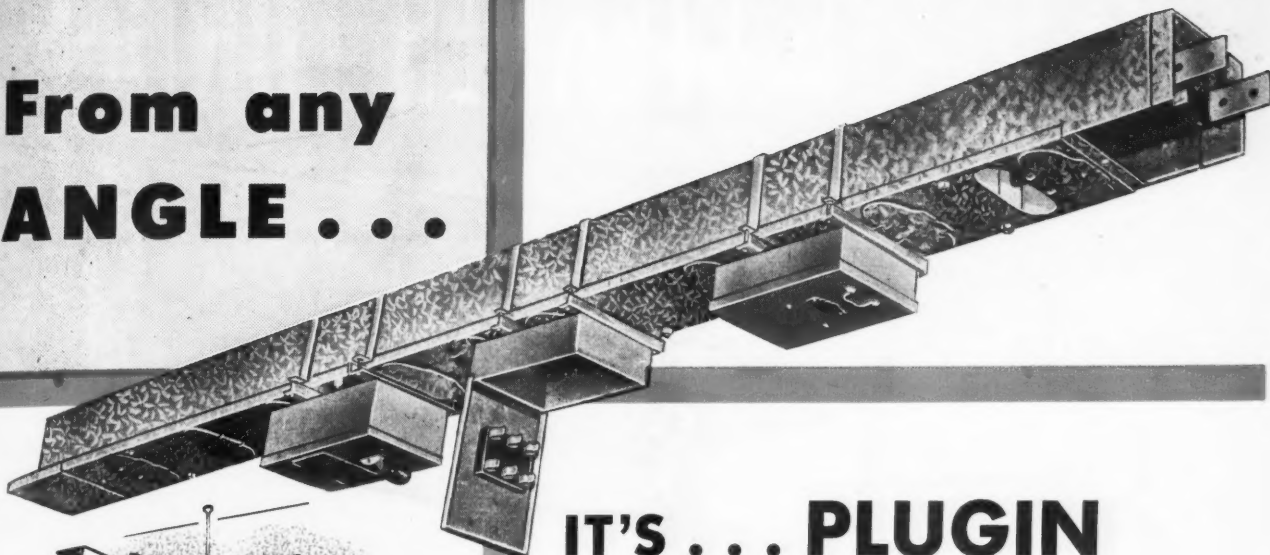
In Canada: Fiberglas Canada Ltd., Toronto, Ontario.



ELECTRICAL
INSULATING
MATERIALS

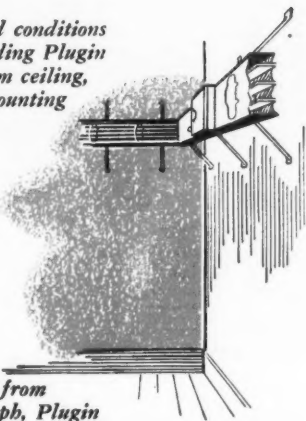
*FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

From any ANGLE . . .

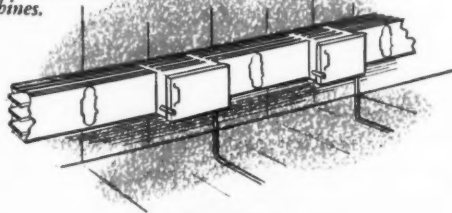


Plug-in **FA** Busduct can be supplied with outlets on both sides (on special order) for ceiling installations, as sketched above . . .

Or, if overhead conditions prevent suspending Plug-in **FA** Busduct from ceiling, special wall-mounting brackets are available . . .



Or, as sketched from actual photograph, Plug-in **FA** Busduct can be mounted close to floor and leads carried across to machines.



IT'S . . . **PLUGIN** **FA** **BUSDUCT**

Take the economy angle! Plug-in **FA** Busduct permits a quick change in plant or electrical layout *without* disrupting production . . . eliminates costly temporary connections and expensive, long lead-ins . . . and greatly reduces maintenance costs and voltage losses.

Take the flexibility angle! Plug-in **FA** Busduct provides a ready power source for new and present equipment anywhere along the line . . . a plug-in outlet every foot of the way. Available in standard 10-foot lengths, **FA** Busduct can be installed on, or hung from ceilings, along walls, and even above baseboards . . . through tunnels under streets, through roofs or walls . . . and with dustproof or raintite protection.

Take the efficiency angle! Plug-in **FA** Busduct saves much needed time in the installation and relocation of machinery and in day-to-day maintenance of the electrical system.

For more information see your **FA** Representative (he's listed in Sweet's) or write for Busduct Bulletin No. 701.

You'll agree that Plug-in **FA** Busduct is the Most Economical Path From Power Source to Equipment.



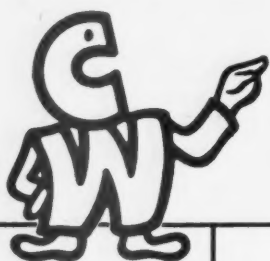
Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKMEYER

It STAYS CLEANER LONGER..

See why the



C-W SEALEDPOWER

TOTALLY-ENCLOSED...FAN-COOLED MOTOR
SAVES 80% OF MAINTENANCE COSTS

COMPARE CLEANING COSTS!

| | Conventional* Fan-Cooled Motor | VS | C-W Sealedpower Motor |
|---------------------------------|--|----|---|
| | Normal (Not Extra Dirty) Service | | |
| FREQUENCY | EVERY YEAR a conventional fan-cooled motor requires cleaning, in the opinion of experienced maintenance chiefs. | | ONCE EVERY 3 YEARS is often enough for a Sealedpower motor, according to those who have had experience with it. |
| OPERATIONS REQUIRED | 17 OPERATIONS—to shut down, dismantle, clean and reassemble motor. Motor must be shut down and taken out of production, for about 3 hours. | | NO NEED TO SHUT DOWN in normal—not extra dirty—duty; no need to remove fan cowl, etc. Brushing cowl end, and cleaning outside of motor is sufficient. |
| TIME, LABOR COSTS | \$4.95 3 HOURS time, estimated by motor maintenance men, at union scale of \$1.65 per hour, totals \$4.95 yearly per motor, in normal service. | | 14c ¼ HOUR time, once every 3 years, cleans a Sealedpower motor. At \$1.65 per hour, cleaning cost per year is only 14¢. |
| COSTS IN ABNORMAL SERVICE | EVERY 3 MONTHS, a conventional motor, operating where dirt or lint is excessive, should be cleaned. That requires 18 hrs. of labor at \$1.65, for a total cleaning cost of \$29.70 per motor, during an interval of 18 months. | | ONLY ONE cleaning every 18 months keeps a Sealedpower motor running cool and efficiently. Only ¼ hour to remove fan cowl, brush fan and outside of motor and replace cowl. A labor cost of only \$1.24 per motor. |

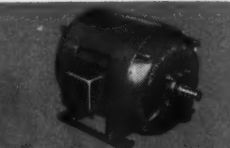
*A totally-enclosed, fan-cooled motor, of conventional design, was used for comparison

You get this dollar-saving design only when you specify C-W Sealedpower Motors. No other totally-enclosed, fan-cooled motor has exterior cooling, with the fan-driven airstream blowing over the finned frame, carrying dust and fumes outside and away. It beats rust and corrosion,

too, because the frame is rugged cast iron.

RATINGS FROM 3 TO 60 HP, horizontal or vertical, with NEMA "C" or "D" flange mountings. Many ratings are stocked . . . see C-W's weekly Stock Sheet. Talk over your motor needs with a Crocker-Wheeler representative.

FOR ANY APPLICATION WHERE
EXCESSIVE MAINTENANCE IS INDICATED
—specify SEALEDPOWER and SAVE



Protected-Type Motors



Direct Current Motors



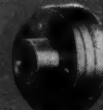
Sealedpower Motors



Generators



Wound Rotor Motors

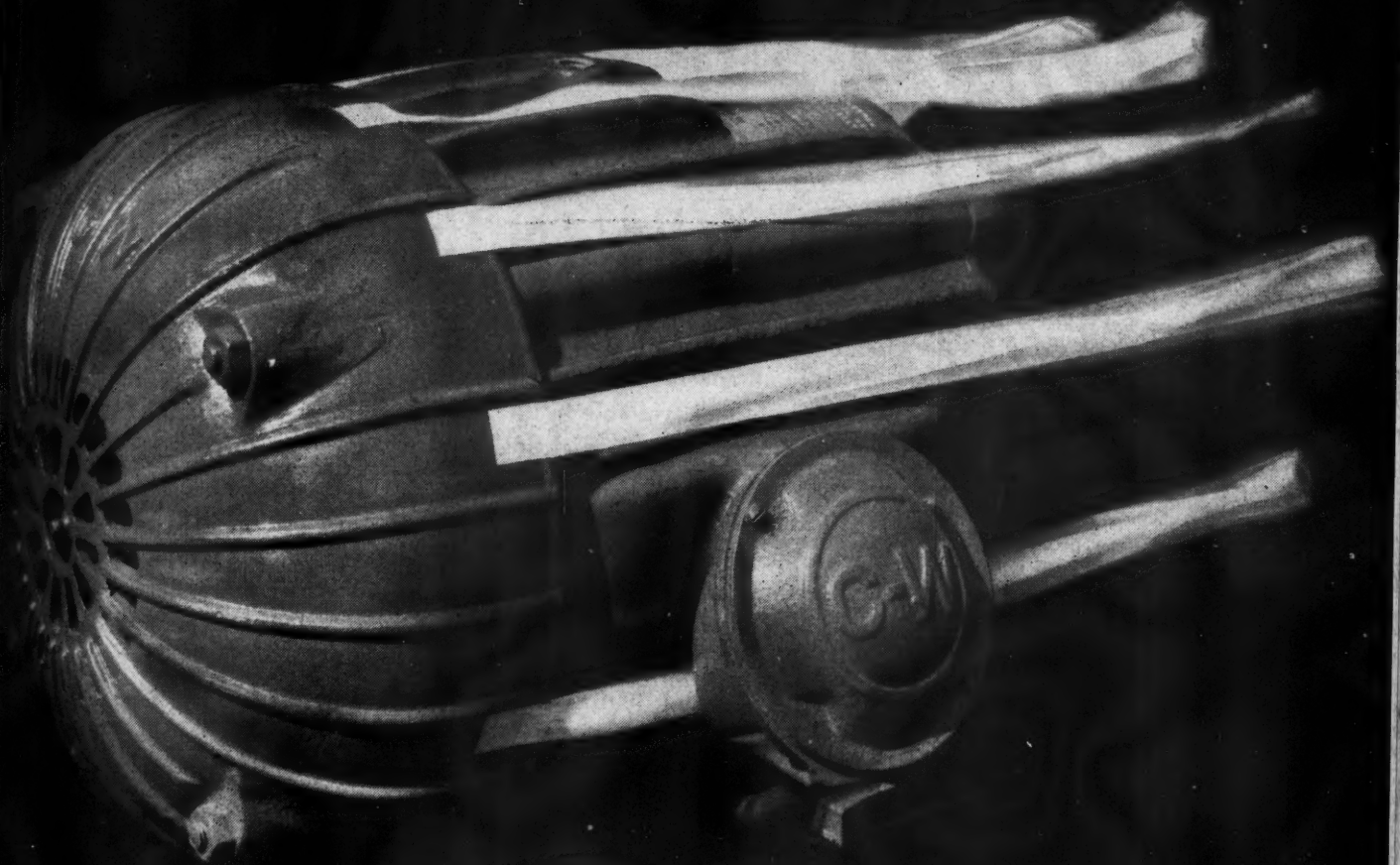


Flexible Couplings

... SKIPS SHUTDOWNS

150° MORE
COOLING SURFACE

is provided by the radiating fins, exclusive with the C-W SEALEDPOWER. Here, fluttering streamers trace the fan-driven airstream that blows dust and fumes outside and away.



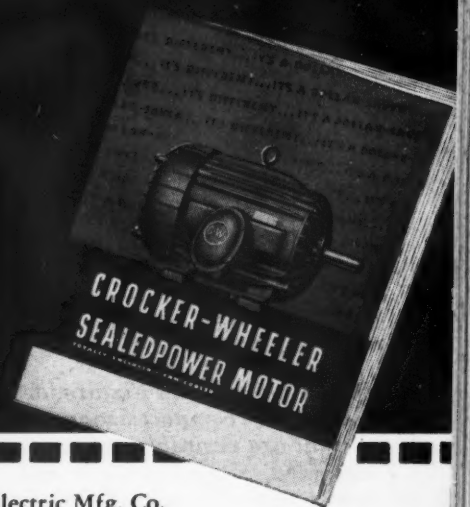
CROCKER



WHEELER

ELECTRIC MANUFACTURING COMPANY, AMPERE 3, N. J.
A Division of The Joshua Hendy Corporation

Branch Offices:
Boston, Buffalo, Chicago, Cincinnati, Cleveland, Los Angeles, Milwaukee,
New York, Philadelphia, San Francisco, Pittsburgh, Washington, D. C. —
Representatives in principal cities.



Before You Buy ANY totally-enclosed motor, be sure to read why SEALEDPOWER will prove a "maintenance miser" for you. This new booklet, "It's Different — it's a Dollar-saver," is packed with facts no savings-minded motor user can afford to overlook. Write for it.

Crocker-Wheeler Electric Mfg. Co.
Ampere 3, N. J.

Send the SEALEDPOWER Motor Booklet, "It's Different — it's a Dollar-Saver".

EC-249

Name

Title or Function

Company

Address

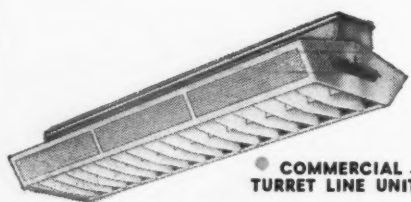


● New Wheeler 5-Inch Turret Socket Fixture for two or three 40-watt lamps. Open or closed end, double or single length.

NOW!

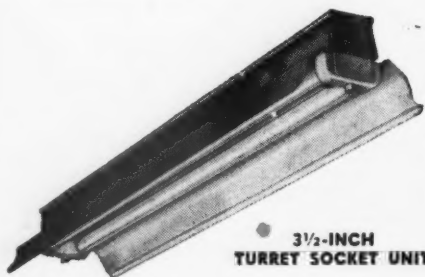
A Complete Line of Up-to-the-Minute

TURRET LINE Fluorescent Fixtures



● COMMERCIAL
TURRET LINE UNITS

An improved commercial fluorescent fixture for offices, stores, hospitals, schools, public buildings. Special top shield eliminates "hot spot" on ceiling . . . one-piece, hinged lower body cuts glare in line of vision. For two 40-watt lamps . . . 3½" lamp spacing.



● 3½-INCH
TURRET SOCKET UNIT

New Wheeler RLM Fixture for locations where compact size and lighter weight are desirable. Scientifically designed, ruggedly built and finished with Wheeler Triple-Guard Vitreous Porcelain Enamel. For two 40-watt lamps . . . individual or continuous runs.

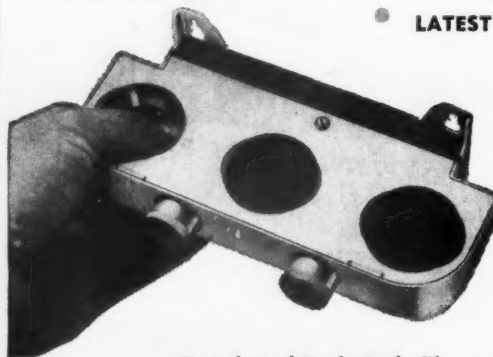
- The addition of new RLM Turret* Socket Fixtures with 5-inch lamp spacing to the Wheeler Turret Line, now makes "Skilled Lighting" available in this most modern, efficient type of fixture for any industrial lighting requirement.

The new Wheeler 5-Inch Turret Line Units are designed to dimensions that afford uniformity in installation with previous Wheeler Units. Made for two and three 40-watt lamps . . . in single or double length . . . with open or closed end reflectors . . . for all standard suspensions . . . individual or continuous runs. Finished in Wheeler Vitreous Porcelain Enamel.

Like other fixtures in the Wheeler Turret Line, this new unit has the new G.E. Turret Lampholders. No socket breakage . . . no falling lamps . . . speedy relamping . . . vibration-proof.

Before you specify fluorescent fixtures for any installation, get full information on the new, improved Wheeler Turret Line. Write the WHEELER REFLECTOR CO., 275 Congress Street, Boston 10, Mass.

● LATEST TYPE LAMPHOLDERS



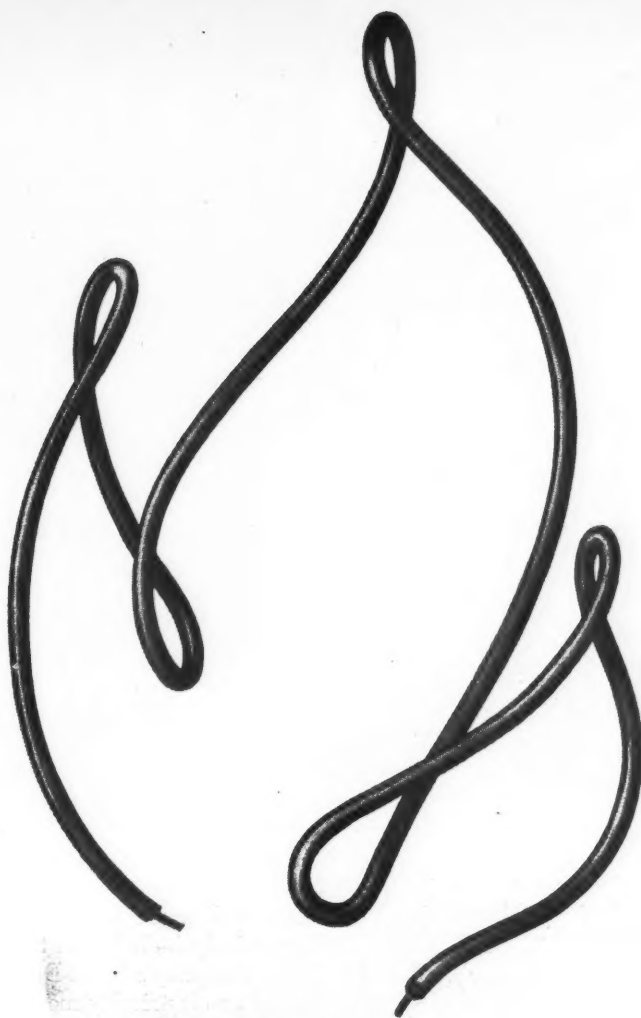
An outstanding feature of all Wheeler Turret Line Units is the new G.E. Turret Lampholder. Insures constant spring tension. Saves money and maintenance. No socket breakage . . . no falling lamps . . . speedy relamping . . . vibration-proof.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTORS
SKILLED LIGHTING

*Reg. U. S. Pat. Off.

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881



IS YOUR NEW DESIGN **HOT** IN MORE WAYS THAN ONE?

New designs in radio, television and electrical appliances call for resistance to higher temperatures. . . . And here's just the wire to make connections wherever higher ambient temperatures must be met.

It is Intelin IN-108—product of the Selenium-Intelin Division of Federal Telephone and Radio Corporation. Its insulation, developed by Federal, is based on VINYLITE Brand Plastics.

This construction has received Underwriters' Laboratories approval for operation at 90° C.

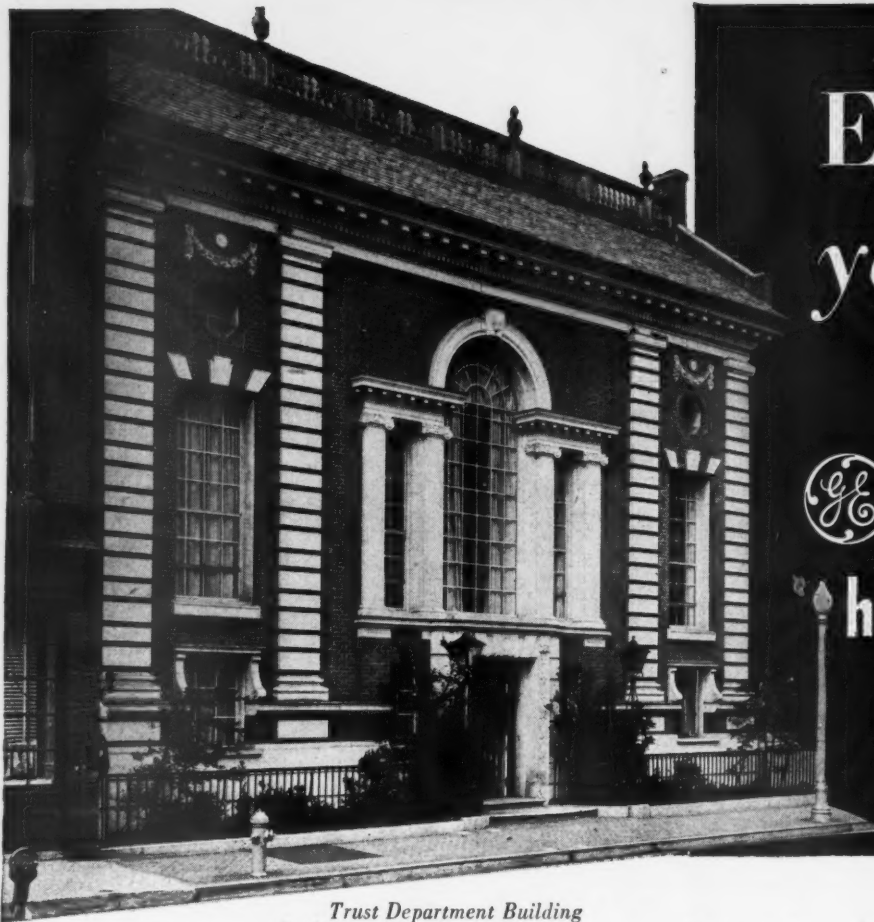
Economical VINYLITE Brand Plastic insulation

materials are bringing many other equally spectacular advantages to wire and cable users. They provide thinner walls, saving space and, of course, weight. All types are highly resistant to abrasion, to most chemicals, to grease, oil, alkalis, moisture and sunlight.

Even at low temperatures, VINYLITE Plastics are inherently flexible. Either non-flammable or slow-burning types are available. Write Department ES-41 for full information. Ask for the informative booklet entitled: "VINYLITE Plastic Wire and Cable Compounds."



BAKELITE CORPORATION, Unit of Union Carbide and Carbon Corporation  30 East 42nd Street, New York 17, N. Y.



Trust Department Building
Bridgeport City Trust Company
Bridgeport, Connecticut

This standard double-duct system has easily kept pace with electrical outlet demand; capacity is still more than adequate for future needs.



Eighteen years old

... but



FIBERDUCT has kept it young electrically

Because General Electric Fiberduct underfloor raceways were wisely included in the plans for the Bridgeport City Trust Company's Trust Department Building, this building is still as electrically modern and young as the day it was built, eighteen years ago. The Fiberduct system has easily kept pace with the additional electrical outlets needed for the increasing number of electrically operated business machines. Desk and equipment arrangement has not been hampered because electrical and signal outlets have always been rapidly available.

With General Electric Fiberduct raceways, it's easy to provide new outlets. It is only necessary to make a small opening in the floor over the raceway for the insert, pull the wires through, and connect the outlet. The job is done without interruption of the building's facilities and with no annoyance to personnel. Compare this with the fuss and bother of digging a channel in the floor, cutting, shaping, and installing conduit, and recementing.

When you're in the planning stage of any project, whether for new construction or modernization, consider these advantages of G-E Fiberduct raceways: (1) their adaptability to changes in building layout; (2) their ability to meet unforeseen demands on electrical capacity; and (3) their flexibility for use with new types of electrical equipment.

If you'd like to know more about this adaptable system, contact your nearest General Electric merchandise distributor, or write to Section C13-218, Construction Materials Dept., General Electric Company, Bridgeport 2, Conn.

GENERAL  ELECTRIC

BLACKBURN *Hi-Strength* CONNECTORS

for Making Taps
and Connections

BEST

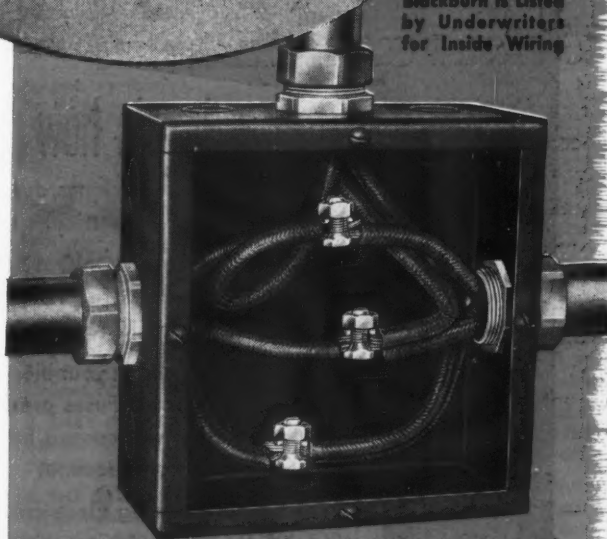
because of these

5 Advantages

- The **UNIVERSAL** connector—ideal for any use.
- The **HANDY** connector—very easy to use.
- The **ECONOMICAL** connector—low initial cost plus labor saving.
- The **COMPACT** connector—small, easy to tape.
- The **RELIABLE, PERMANENT** connector—made of **DURONZE**, 50% stronger than hard copper or commercial bronze. High strength, at no extra cost!



Blackburn is listed
by Underwriters
for Inside Wiring



Tap made in junction box with
Blackburn Hi-Strength Connectors

Mail Coupon for Sample Connector

JASPER BLACKBURN PRODUCTS CORP.,
First, Madison & Clinton Sts. • St. Louis 6, Mo.

Send me, without obligation, a sample Blackburn Connector, prices,
and name of nearest jobber.

Individual Name & Title _____

Firm Name _____

Address _____

ECM

ORDER FROM YOUR JOBBER

JASPER BLACKBURN PRODUCTS CORP.

BUILDERS OF QUALITY PRODUCTS FOR 15 YEARS

FIRST, MADISON AND CLINTON STS., ST. LOUIS 6, MO.

Phone: Central 3007

NEW ELECTRICAL DEVELOPMENTS

#5

Prevent Interruptions to Electrically-Operated High Production Machines



NEW Multiple-Spindle Automatic SCREW MACHINES

Six independently cammed cross-slides are radially arranged about the spindle carrier axis, making possible the same line of forming thrust for every position; minimizing overhang, and allowing you greater interchangeability of holders.

MODERN **ECONOMY**

"De-Lay" Renewable Fuses

here's how to prevent interruptions

to high-production machines, due to momentary overloads and "fuse" blows in electrical circuits.

Use **ECONOMY "De-Lay" Renewable Fuses**, which give safe protection where most overloads occur—in the 135 to 200% range.

Placed in your electrical circuits, **ECONOMY "De-Lay" Renewable Fuses** prevent many "Blackouts" otherwise caused by current surges lasting only a fraction of a second.

Leading Electrical Wholesalers stock **ECONOMY "De-Lay" Renewable Fuses** and Renewal Links.

You are invited to write for the New Economy Catalog.

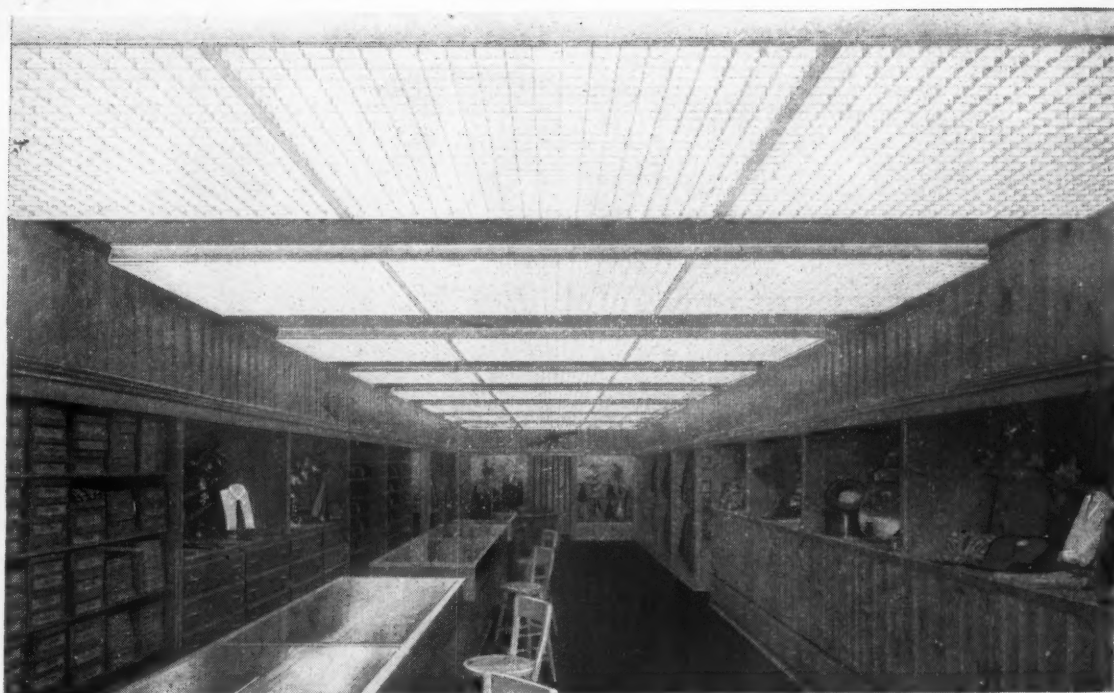


ECONOMY FUSE & MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILL. REPRESENTATIVES IN ALL PRINCIPAL CITIES

2767

LPI PANELUX and Fi-bord

"Bring the Rainbow Indoors"



1. COMPLETE FIXTURE... Each Panelux is a complete unit, with chassis, louvers and hangers. Installation is a single operation, eliminating any need for individual fixtures and louvers installed separately.

2. FOUR SIZES... The four Panelux sizes can be joined together end-to-end or side-by-side to achieve any desired pattern.

3. MODERN DESIGN... High reflection, brightness control and a shielding angle of 38° provide comfortable, glareless illumination. Proper light distribution virtually eliminates shadows.

1. FIVE COLORS... Fi-bord (fiber-board) Louvers are available in white and in pastel shades of blue, green, pink and yellow. Colors can be used individually or in attractive combinations.

2. EASY INSTALLATION... Fi-bord is light in weight and easy to handle. Folded sections open quickly for installation in less than two minutes per unit. A light metal angle keeps louvers rigid.

3. NO MAINTENANCE... You *don't* clean Fi-bord Louvers. You *replace* them — at less cost and in less time than are required for cleaning any other louvers. Replacement requires only one man.

Here's the fluorescent luminaire with Fi-bord Louvers in five colors that bring the rainbow indoors. Wholesalers, contractors, architects and engineers all agree that this combination produces the world's finest louverall ceiling.

Remember, only LPI has Panelux, and only Panelux has Fi-bord Louvers. Write LPI today for Panelux Bulletin No. 420, or contact the LPI Representative nearest you.

All LPI fixtures are union made (I.B.E.W.—A.F. of L.)
They're sold nationally through leading electrical wholesalers

Lighting PRODUCTS, INC.
HIGHLAND PARK, ILLINOIS

*Trade Marks—Patents Pending

ELECTRUNITE

...TIME-PROVED IN CONCRETE



—THE *Original* E.M.T.

RACEWAY INSTALLATIONS

✓ For raceways in concrete, Republic ELECTRUNITE—the *Original* E.M.T.—offers a combination of advantages which cannot be duplicated by any other type of conduit.

Because this modern steel conduit is threadless, light in weight, and uniformly strong and ductile throughout every length, it goes in *easier* than old-fashioned heavy raceways. Simple compression fittings eliminate the need for threaded tube ends—hence eliminating the need for excess wall metal to act as a base for thread-cutting. Joints made with approved fittings are completely water-tight and may be used safely in any type of concrete construction.

Inspection by Underwriters' Laboratories and approval by the National Electrical Code constitute positive assurance that ELECTRUNITE E.M.T. provides adequate electrical and mechanical protection throughout each installation.

For the full story about the many cost-saving advantages of ELECTRUNITE E.M.T. in today's wiring picture, see your nearest ELECTRUNITE Distributor, or write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.



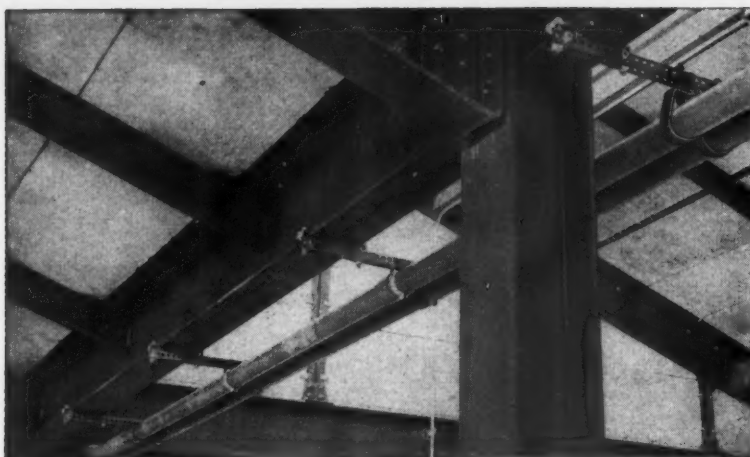
With compression fittings, no threads are necessary in the raceway wall. Tightening the outer ring of the coupling (indicated by pencil) creates a strong, water-tight joint which offers high resistance to pull-out and vibration.

ELECTRUNITE E.M.T. eliminates the need for turning the raceway into the fitting. Just slip the coupling or box connector onto the end of the tube and tighten with wrench or pliers—that's all there is to it.



Republic
ELECTRUNITE E.M.T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY



KINDORF DEVICES supporting conduit from beams of different depths—clearing structural columns.

NO BENDING—NO DRILLING—NO WELDING

with No. 100 KINDORF CHANNEL



and FOUR BASIC MULTI-USE FITTINGS



CHANNEL TYPE
SPACER



BOLT TYPE
SPACER



BEAM CLAMP



ANGLE
CONNECTOR

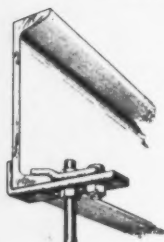
You can form many assemblies, each with continuous slots that receive the low-cost KINDORF CONDUIT STRAP. These assemblies support multiple runs of conduit in single or several tiers—direct to beams, suspended from beams—and many other combinations such as the cantilever type installation above.

PLUS

A complete line of single conduit hangers and supports with a METHOD that does a better job at LESS COST.



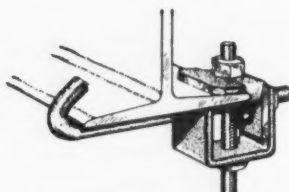
CONDUIT STRAP



ADJUSTABLE
CHANNEL CLAMP



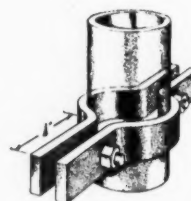
BEAM CLAMP WITH
SWING CONNECTOR



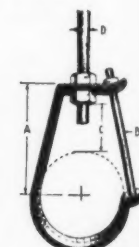
ADJUSTABLE BEAM CLAMP



CEILING
FLANGE



RISER CLAMP



ADJUSTABLE
CONDUIT HANGER

Nation-wide distribution through authorized electrical wholesalers

Ask for complete catalog which contains application data with illustrations.

THE KINDORF COMPANY • 681 Market St. • SAN FRANCISCO 5, CALIF.

KINDORF DEVICES

Want to Start Something?

USE CLARK PUSH BUTTONS

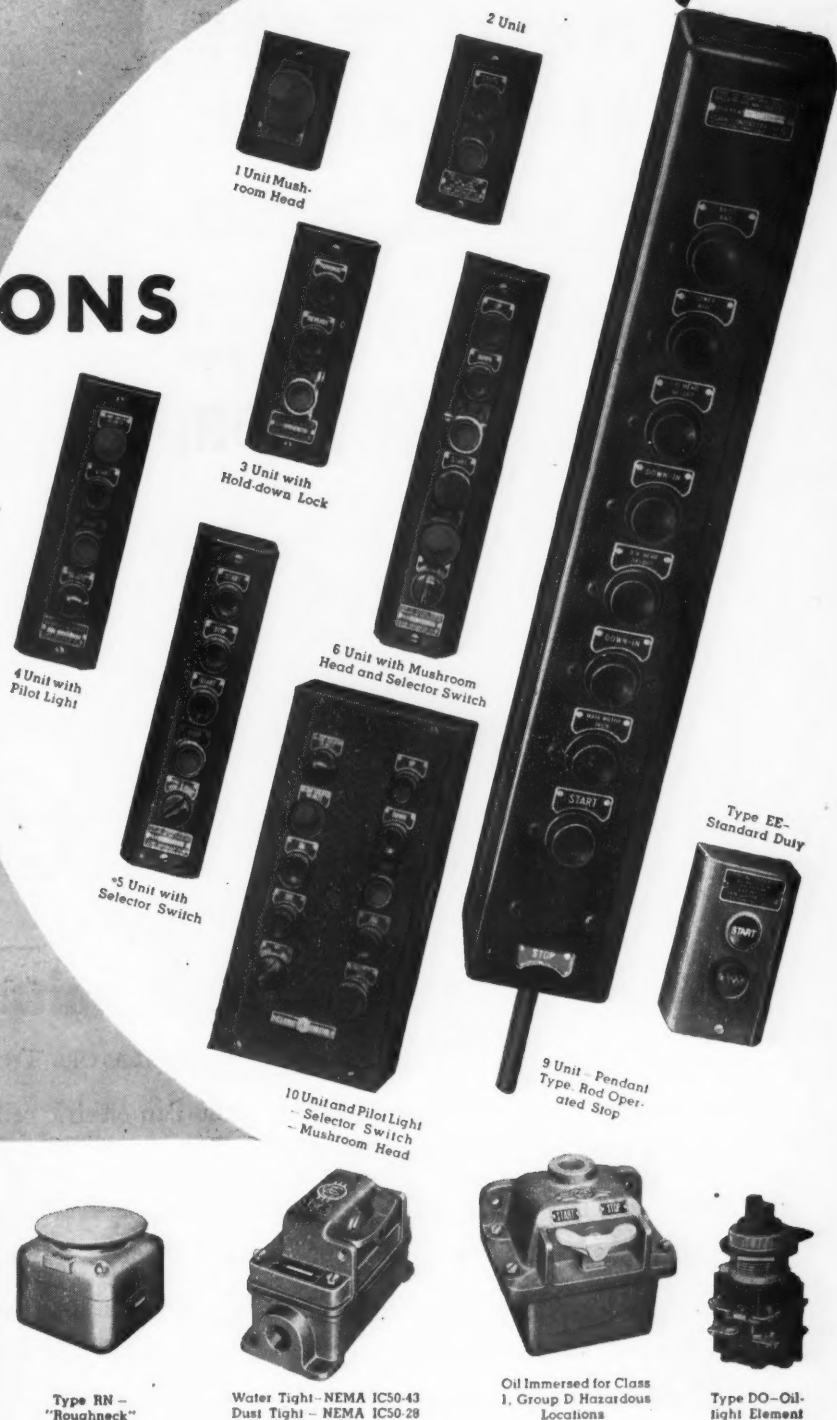
CLARK Type D Push Buttons, featuring silver-to-silver, button-type, double-break contacts, bakelite insulating parts, large electrical clearances, and plenty of wiring space, provide low maintenance and long life in heavy duty operations. Push button stop is independent of contacts. 1½" and 2¼" mushroom heads are available.

Type RN—the "ROUGHNECK"—has mushroom head, cast metal enclosure with rounded shoulders sturdy enough to take rough usage.

Watertight, dust tight, and oil-immersed types can be supplied. Pendant Stations are also available.

Type EE Push Buttons are for use on ordinary starter applications with contactors or starters up to and including NEMA Size 4, 150 Ampere Size. Available only in standard pressed steel enclosures, finished in Machine Tool Gray, and not subject to modifications.

Type DO is a Heavy Duty Oil Tight Element for mounting in machine tool applications . . . Oil Tight Selector Switches and Pilot Lights also available.



For every industrial application there's a CLARK Push Button Station available through your CLARK distributor.



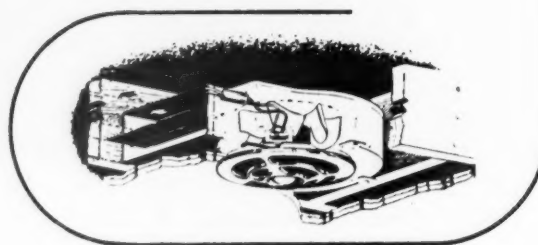
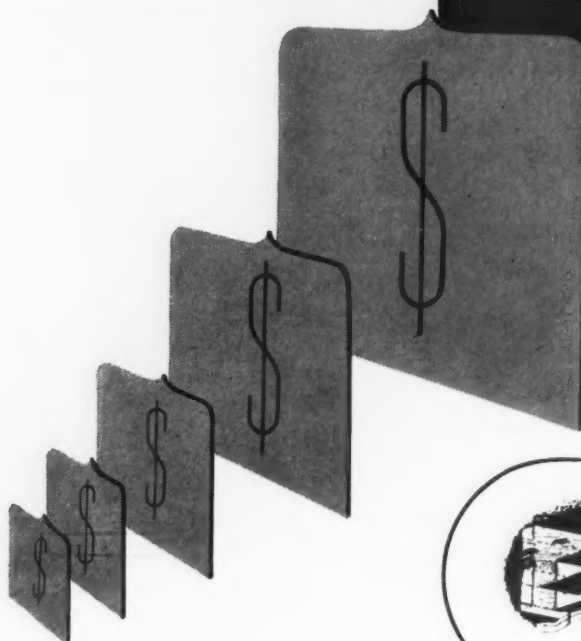
THE CLARK CONTROLLER co.

1146 EAST 152nd STREET, CLEVELAND 10, OHIO

MORE JINGLE IN THE CASH REGISTER

WHEN YOU SELL

Blo-Fan



ELECTRIC CEILING VENTILATORS THAT BUILD IN OVER THE RANGE!

You can make as much profit installing a Blo-Fan electric ceiling ventilator on your next job as you can with 15 or 20 additional outlets.

AND IN LESS TIME. Blo-Fan roughs-in between standard joists like any outlet box. Motor assembly snaps into housing without tools after job is finished. Easy to install.

FITS ANY JOB. Blo-Fan installs in the ceiling—fits into any kitchen plan directly over the range ...where a fan belongs. Blo-Fan ducts through either side wall or roof as desired.

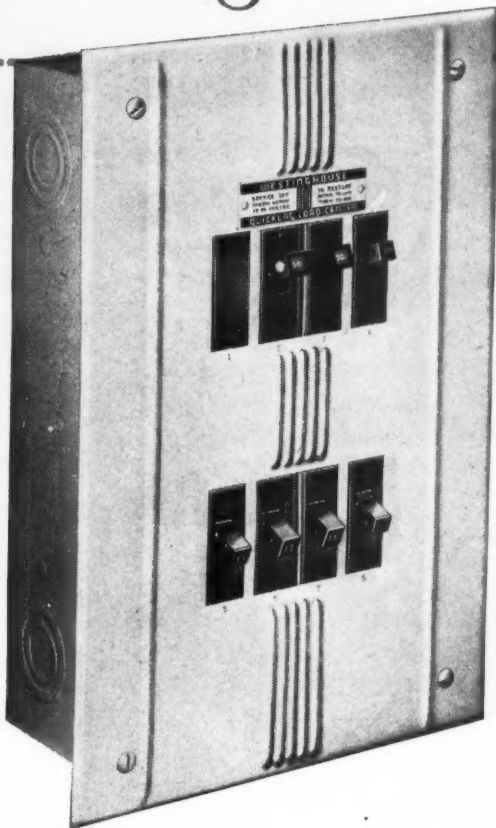
AVAILABLE ON THE SPOT. Stocked by 500 electrical wholesalers covering all sections of U. S. Write for complete catalog and name of distributor.

Blo-Fan

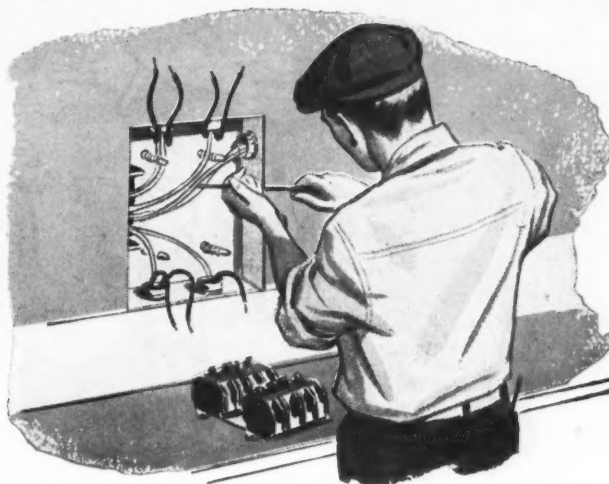
Volume of a propeller, Power of a blower.

PRYNE & CO., INC. POMONA, CALIFORNIA • LOS ANGELES
SAN FRANCISCO • CHICAGO • NEW YORK

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



ANNOUNCING THE *NEW* QUICKLAG LOADCENTER



Dependable Protection with "job-site" Flexibility

The new Quicklag Loadcenter has the kind of features you've wanted most in a modern, fuseless protective device, Flexibility, for example: With only a minimum stock of basic components, you can tailor the Quicklag Loadcenter to fit the circuit requirements of any home . . . and you can do it *on the job!* If the breakers in the loadcenter are not the desired capacity, you need only replace them with properly rated units. The breakers simply snap into place.

The Quicklag design assures maximum dependability by providing combined thermal-magnetic action. Two tripping forces are employed to assure positive operation on shorts or sustained overloads regardless of the frequency of their occurrence.

Dependable operation . . . "job-site" flexibility;

these are features that help you to be sure . . . sure of doing the kind of job that will provide lasting benefits for you and the home builder alike.

J-60691

Booklet B-3881, just off the press, explains every advantage of Quicklag Loadcenters. Your nearest Westinghouse office will supply a copy or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.



Westinghouse

QUICKLAG LOADCENTERS





Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

IF YOU WANT a tape with a grip you can trust—try Gold Seal. Hot or cold . . . rain or shine . . . it sticks to the job—speeds the work. In every electrical field, it's the favorite.

Laboratory controlled production assures the lasting "tack" in the friction compound. And Gold Seal will not dry out, peel, or smear the hands. Its top quality base cloth tears evenly, quickly, without raveling.

Next time try Gold Seal . . . it's the best buy! Conveniently packed in single rolls or handy 10-roll containers . . . each roll cellophane wrapped to reach you factory fresh. Jenkins Bros., (Rubber Div.), 80 White St., New York 13, N. Y.

JENKINS



Gold Seal Tape

FRICITION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

NATIONAL ELECTRIC

Indestructo

Cables for Heavy Electrical Equipment (0-5,000 VOLTS)

NEOPRENE JACKETED



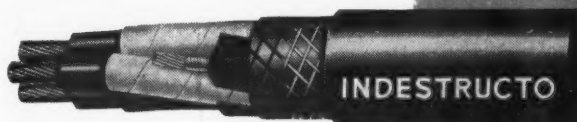
Three-Conductor Type W. Neoprene Sheathed Power Cable.



Super-Flexible Neoprene Sheathed Welding Cable . . . Flexible . . . Long Life.



New Parallel Duplex Neoprene Sheathed Mining-Machine Cable



Three-Conductor Type SH-D Neoprene Sheathed Power Cable. Shielded for Maximum Safety.

More Durable • Safer • Fewer Replacements

NE Indestructo Cable is manufactured from the highest quality materials and specifically engineered to far exceed accepted commercial standards*. Indestructo Cables are tough, strong and durable—for trouble-free service.

There's a size and type of NE Indestructo Cable for every kind of heavy electrical equipment including: Machine tools . . . Excavators . . . Rolling Mills . . . Mining Machines . . . Conveyors . . . Welding Machines . . . Marine Equipment.

Whether your requirements are standard or "special," the NE Cable Engineer can recommend the best cable for your use. Write us today.

*Underwriters' Laboratories, Inc., L.P.C.E.A., Pa. Flame Act 206

National Electric

PRODUCTS CORPORATION

1301 CHAMBER OF COMMERCE BLDG., PITTSBURGH 19, PA.



New H&H No. 9260

BACK-WIRED

(or side
wired)

DUPLEX

T-SLOTS • DOUBLE SIDE CONTACTS PLASTER EARS

This advanced design provides for either *back* wiring or *side* wiring with equal facility. Back-wiring feature makes easier, more secure installation. Built-in stripping guide assures correct stripping; eliminates exposed wire. Individual terminal clamps hold wires with a no-slip grip. Other structural features are:

Large recessed binding screws,
ample for No. 10 wire;

Strong plastic base;

Double T-slots;

Double side contacts;

Washer type plaster ears.

Listed as standard by Underwriters Laboratories, Inc. and meets all high-grade specifications. Specify No. 9260 for brown plastic base; No. 9260-I for white Ivorylite.

10 AMPS. — 250 VOLTS

15 AMPS. — 125 VOLTS



CONVENIENCE

OUTLET

- Large Recessed Binding Screws
- Ample for No. 10 Wire
- Strong Plastic Base
- Double T-Slots
- Double Side Contacts
- Washer Type Plaster Ears

Mail this Coupon

To Arrow-Hart & Hegeman Electric Company, Hartford 6, Conn.

Send us your catalog data-sheet on the new 9260 Back-Wired Duplex Convenience Outlet.

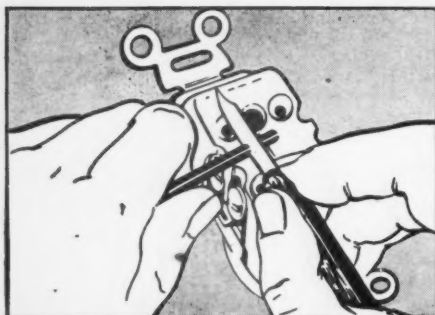
(Name) _____

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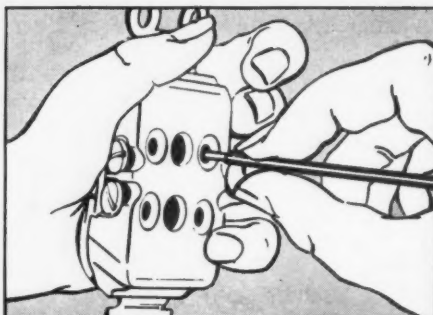
(Address) _____

(City & State) _____

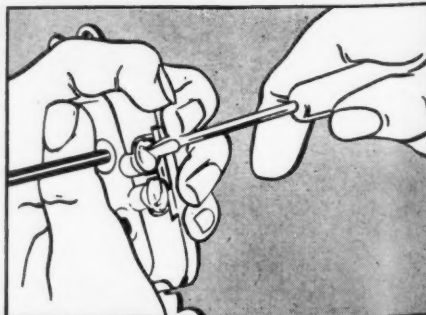
THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD 6, CONN., U.S.A.



1. Strip off insulation to exact length, quickly and easily, using built-in stripping guide.

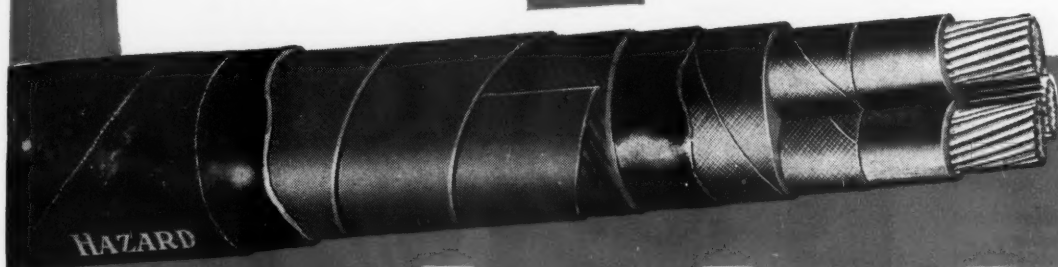


2. Loosen terminal screw — Wire stripped to correct length is inserted from back.



3. Tighten terminal screw — Individual clamps grip securely with no exposed wire.

SAVE **4** WAYS WITH HAZARD ARMORTITE CABLE ON THESE **6** IMPORTANT JOBS:



airport lighting . . . street lighting . . . highway lighting . . .
open air theater lighting . . . athletic field lighting . . . power feeders between buildings

Lower initial cost. Because Armortite Cable requires no costly lead sheath or metal armor for protection, you make substantial savings on the purchase of cable.

Direct burial. All the necessary protection for direct burial is built into the cable itself. Duct costs are eliminated. Long-lived, moisture-proof Hazard Water-tite Submarine insulation safeguards the conductors electrically. Then a double layer of age-resisting, leather-like tape, plastic sealing compound and saturated jute coverings give Armortite its outstanding non-metallic protection against mechanical damage and the other potential enemies to cable buried direct in the soil.

Fast, easy installation. The light weight, and simple construction of this non-metallic underground cable speeds up handling, makes splicing and terminating easier — gives you important installation savings.

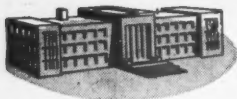
Long, trouble-free service. Years and years of experience have proved that you can forget Hazard Armortite Cable, once it's buried. It continues to carry the load day in and day out with none of those costly, annoying service interruptions. Since 1926, Armortite has set records for long, trouble-free underground cable service. And today, it is made with another improvement that will extend this service even longer. Okobestoprene Tape (asbestos fibres compounded with neoprene) is wrapped over the insulated conductors instead of braid. This provides an additional seal against possible wicking-in of moisture at terminals or joints . . . extra resistance to mildew, acids, flame or alkali . . . permanent circuit identification.

For all the details about this cable, ask your Hazard representative or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

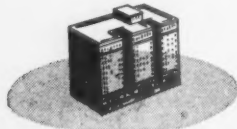
6860

insulated wires and cables for every electrical use



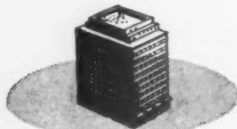
SCHOOLS . . .

A centralized sound system for announcements and bulletins, distribution of radio programs, educational recordings . . . to any or all rooms of a school.



HOTELS . . .

Voice-paging, entertainment in guest rooms and dining rooms, emergency announcing facilities.



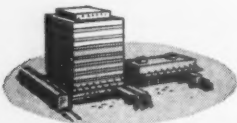
DEPARTMENT STORES . . .

Music broadcasts, merchandise announcements, administrative control.



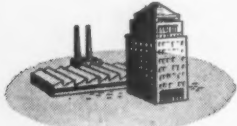
AIRPORTS and TERMINALS . . .

Voice-paging, announce system, entertainment, dispatching.



WAREHOUSES and GARAGES . . .

Traffic control, dispatching, voice-paging.



FACTORIES and OFFICES . . .

Voice-paging, work music from records or radio, news broadcasts, management talks, emergency control . . . plant-wide or at selected areas.



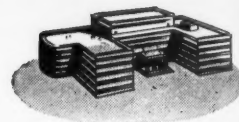
RCA

Plans and Engineers Sound Systems

...for every type of building

PRACTICAL HELP FOR ARCHITECTS and ELECTRICAL CONTRACTORS. No matter what size or type of job you have on your drawing board, RCA will plan and engineer a sound system that will fit your architectural plan. Call upon RCA sound engineers to assist you with your sound system planning and specifications. No obligation, of course.

Contact your nearest RCA Sound System distributor or write: Sound Products, Dept. 118-B, RCA, Camden, New Jersey.



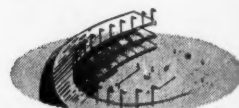
HOSPITALS . . .

Voice-paging, emergency announcements, convalescent entertainment, musical therapy.



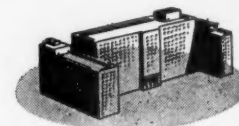
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Complete sound distribution to all parts of the auditorium.



RECREATIONAL CENTERS . . .

Crowd and traffic control announcements, entertainment.



INSTITUTIONS . . .

Voice-paging, administrative control, entertainment, emergency control.



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Complete sound distribution, belfry broadcast equipment.

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The Architects' Manual of Engineered Sound Systems

The most authoritative work book and reference manual published on sound systems. Typical plans and specifications for all types of buildings. 288 pages. Price \$5.00 (\$5.50 foreign).



SOUND PRODUCTS

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

GARDNER TRANSFORMER LEADS

ARE
INSULATED
AND
PROTECTED

With
NATVAR 400

Gardner distribution transformers are built in the new, modern factory building of the Gardner Electric Manufacturing Company, Inc. in Emeryville, California, "close to the center of the most rapidly growing part of the United States."

It is this rapid growth that taxes distribution facilities to the limit, and places a premium on the ability of the equipment to handle "temporary" overloads far in excess of rated capacity. Gardner transformers are now being used by a majority of the principal Power Companies in this Pacific Coast Area.



Core and coil assembly of a Gardner 37.5 kva distribution transformer, 2400—120/240 volts, single phase, 60 cycle. Both high voltage leads from coil to terminal board, and low voltage leads are insulated and protected by Natvar 400 Extruded Vinyl Tubing.

Natvar 400 Extruded Vinyl Tubing, approved for 105°F is used to insulate and protect leads, because it meets operating temperature requirements, and in addition, has uniformly superior resistance to oil.

Prompt deliveries can be made either from a nearby wholesaler's stock or direct from our own. Full Underwriters report on request.



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- Varnished cambric—straight cut and bias
- Varnished cable tape
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- Slot insulation
- Varnished tubings and sleeveings
- Varnished identification markers
- Lacquered tubings and sleeveings
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- Extruded vinyl identification markers

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THE NATIONAL VARNISHED PRODUCTS
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NATVAR: RAHWAY, N. J.

205 RANDOLPH AVENUE ★ WOODBRIDGE NEW JERSEY

SEALED BEARINGS PROTECT R & M MOTOR PERFORMANCE

No re-greasing for
at least Five Years

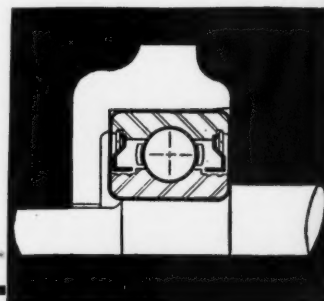
• Year after year without oiling—that's an important, *money-saving* advantage of Robbins & Myers Uni-Shell motors. And it's a typical benefit of the attention to detail that makes these motors so dependable. To provide this "protected performance," every R & M Uni-Shell motor has pre-lubricated, *sealed* ball-bearings.

YOU SAVE ON MAINTENANCE

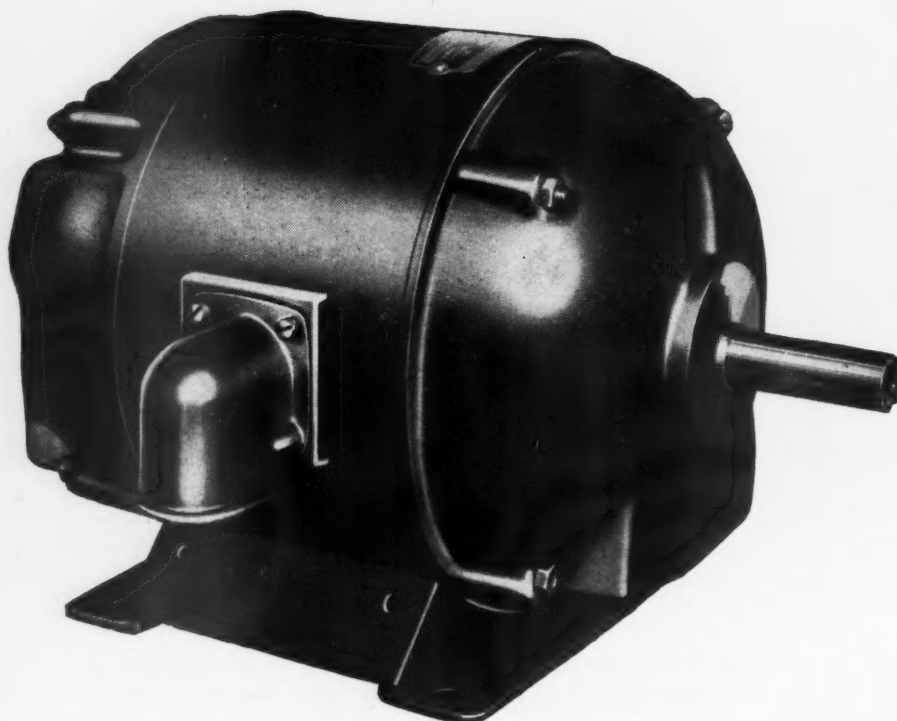
R & M bearings are factory-lubricated for *at least five years*. They are double width, with an extra-large grease reservoir. Bearing seal keeps grease in, dirt out—prevents destructive over-lubricating. And the precision construction of Uni-Shell housings assures perfect, *permanent* alignment. This type of bearing, proved first in the laboratory by complete quality-control tests—including vibration, temperature, and corrosive salt spray—gives outstanding performance under all service conditions.

AVAILABLE ON ALL MOTOR TYPES

Drip-proof, splash-proof, or totally enclosed, with and without fan cooling, R & M sealed-bearing motors include all types . . . for every purpose . . . in sizes to 30 H.P. Be sure *you* get protected performance—get R & M motors. Prompt delivery. Write for free Catalog No. 1845. Robbins & Myers, Inc., Motor Division, Dept. B-29, Springfield 99, Ohio.



The trouble-free,
cartridge-type
bearing.



R & M Uni-Shell MOTORS

CRESCENT

Aluminum Building Wire

An Excellent Alternate For Copper



*Immediately Available
From Trenton, New Jersey, Stock*

Aluminum feeders, particularly in the larger sizes show a substantial saving in cost per ampere of useful circuit capacity in most cases as compared with copper. CRESCENT Aluminum Building Wire is made with ENDURITE heat-resistant insulation in sizes number 4 AWG to 500,000 C. M. as Type RH - 75°C - 600 Volts. Send for Bulletin 471 for complete information.



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TRENTON, NEW JERSEY



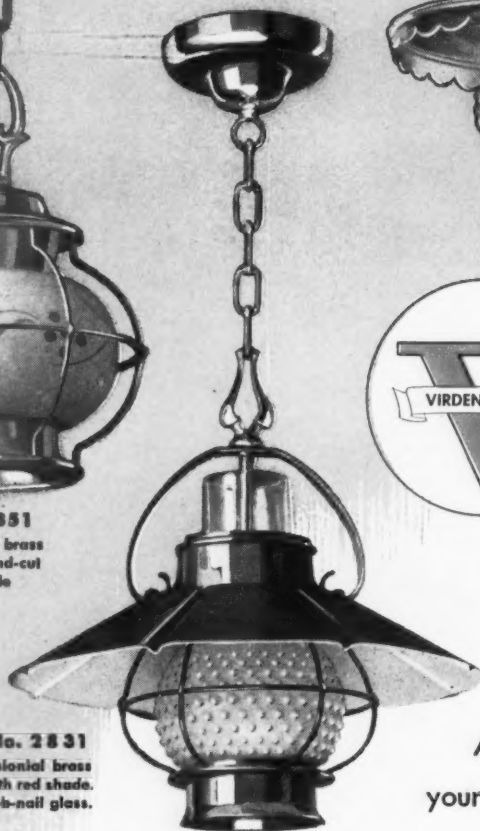
Colorful Colonial

by Virden

FOR DINETTE OR HALLWAY

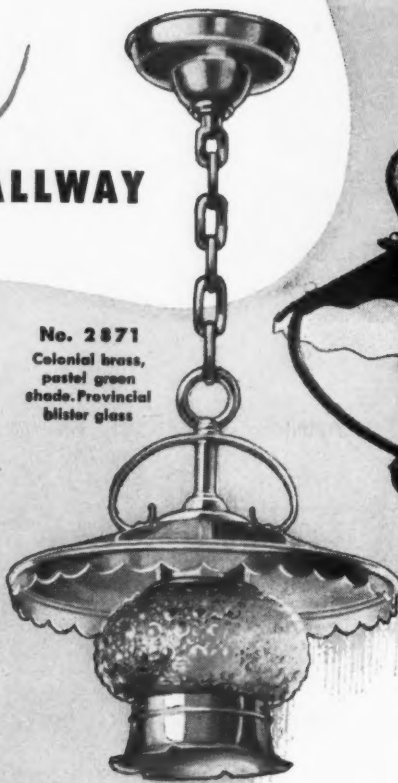


No. 851
Colonial brass
with hand-cut
shade



No. 2831
Colonial brass
with red shade.
Hob-nail glass.

No. 2871
Colonial brass,
pastel green
shade. Provincial
blister glass



No. 3031
Polished copper
and rusty iron.
No. 2851
Colonial brass
and canary
yellow shade.



These charming colonial fixtures by Virden add a bright touch of cheer in new homes or old.

Customers welcome not only their pleasing decorative quality but their moderate prices—Virden values that grow out of tasteful designs planned for Virden mass production skill.

As always, you'll get quick action from your Virden jobber.

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TRADE MARK ®

The Seal of Proven Quality

OVER A QUARTER CENTURY OF TRANSFORMER EXPERIENCE IS BACK OF THE NAME PLATE ON EACH STANDARD TRANSFORMER



Veteran transformers, on the job many years and still delivering full performance, are one testimony of STANDARD'S engineering soundness and craftsmen construction. STANDARD'S leadership in contributing improvements to transformer design and building is another. Yet another qualification for your consideration, is STANDARD'S extensive experience in designing and building for special needs. Whether your transformer need is for a low voltage midget or a high voltage giant, STANDARD can best serve your need.

USE STANDARD'S ENGINEERING SERVICE

Our representatives are qualified to discuss transformer needs with you. Save the time of your engineering staff by permitting STANDARD to work out details of transformer application.

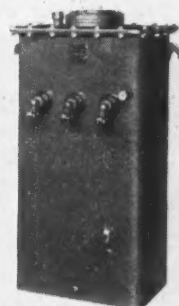
THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

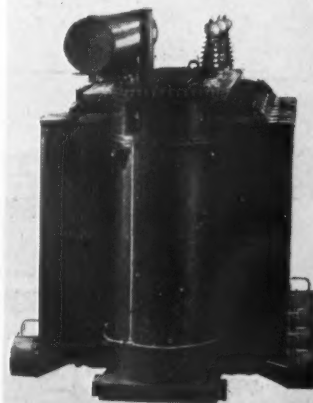
Representatives in Principal Cities



SMALL LOW VOLTAGE DRY TYPE

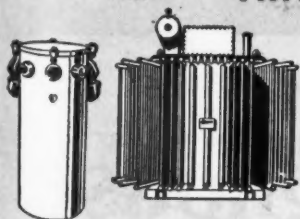


ASKAREL FILLED DISTRIBUTION TYPE

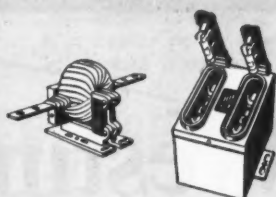


10,000 KVA POWER TRANSFORMER

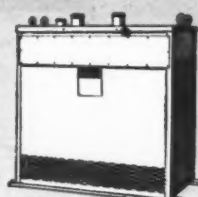
TRANSFORMERS FOR EVERY APPLICATION



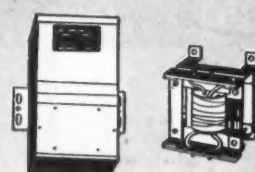
Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)



Dry type (up to 1000 KVA and max. voltage ratings of 4800)



Control transformers (compound filled or open type)

OVER A MILLION INSTALLED KVA in Westinghouse

Dry-Type Power Centers

"A million installed kva" in itself is not important. What is important is that these modern Dry-Type Power Centers are doing an efficient job . . . a job of meeting today's production problems by providing *dependable* and *economical* distribution of power.

They combine the necessary high-voltage switching equipment, a dry-type transformer, low-voltage switchgear and the necessary auxiliaries into a compact, completely enclosed and fully co-ordinated unit.

Their "Unitized" design permits the addition of feeders as required by changes in the load. They can be installed quickly and at low cost . . . *near the load center*. This reduces losses and im-

proves voltage regulation. Long runs of costly copper are eliminated. Add to this the other advantages of Dry-Type Power Centers . . . fire and explosion-proof . . . no vaults required . . . lighter weight. These are the reasons it will pay you to investigate modern Dry-Type Power Centers for your distribution systems.

Modern Westinghouse Dry-Type Power Centers can be supplied for use in any distribution system whether radial or network . . . where the high voltage is 15 kv and below. CONSULT WESTINGHOUSE. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-97135



Indoor Dry-Type Power Center with primary switch and built-in panelboard.



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

What is YOUR power distribution problem ?

The importance of a power distribution system in an industrial plant makes it almost imperative that the *best system* be selected and included in the very basic planning for expansion or new building.

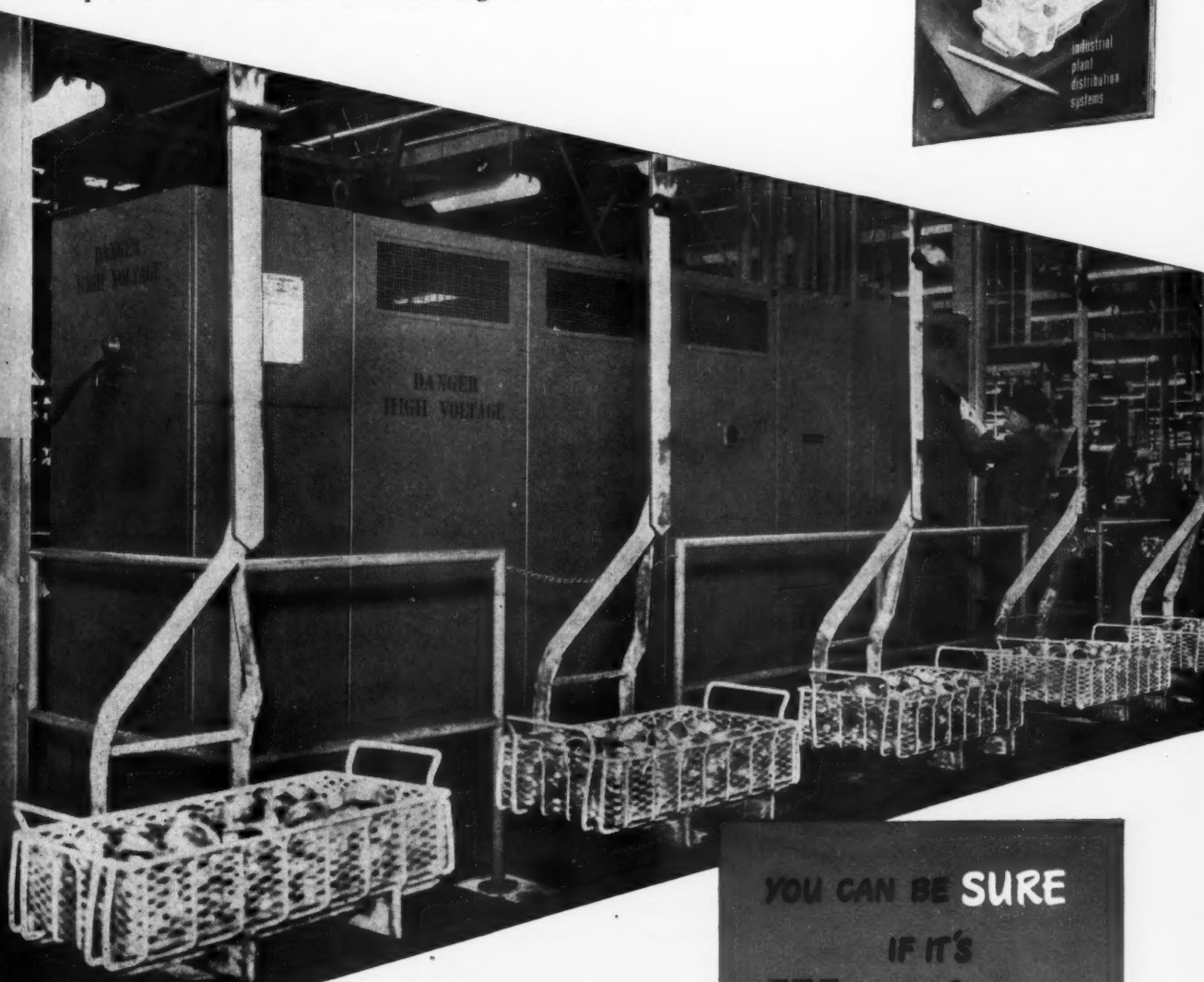
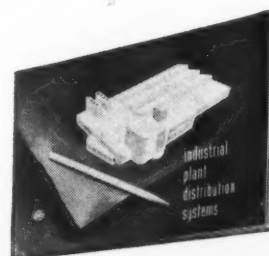
The problems of power distribution vary greatly from plant to plant. Meeting these problems for widely diversified industries has given Westinghouse an intimate knowledge of fields that undoubtedly closely touch *your* problem. Westinghouse offers complete co-operation to all industries in searching out

better answers to all phases of the distribution and application of power.

★ ★ ★

Write for the new booklet "Industrial Plant Distribution Systems"

If you're considering expanding or building a plant, you'll find this booklet invaluable in choosing a distribution system that best meets *your* requirements. Ask for B-4045.



A Dry-Type Secondary-Network Power Center installed in a large mid-western industrial plant. Note it is located in the immediate load area which it serves.

YOU CAN BE SURE
IF IT'S
Westinghouse

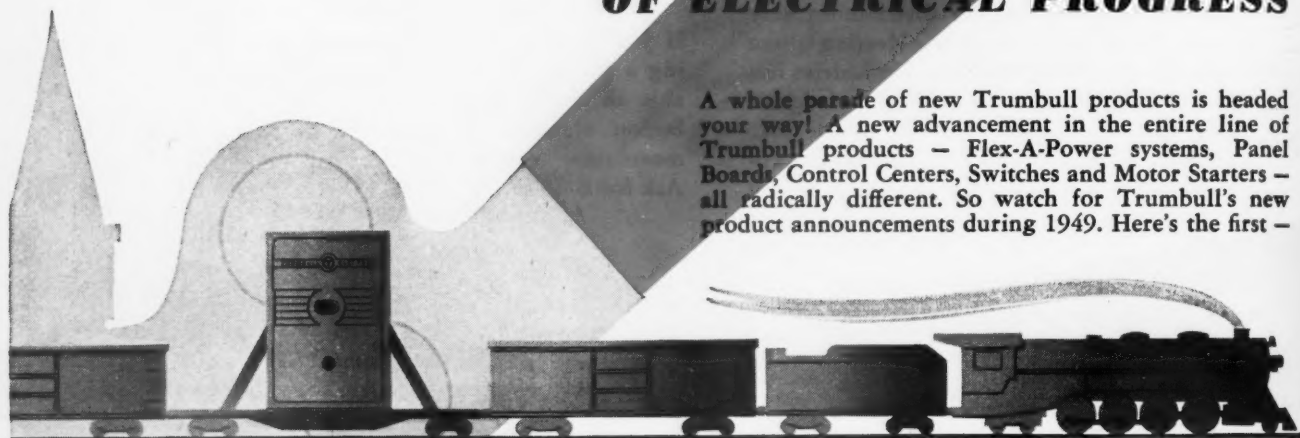
MODERN EQUIPMENT FOR MODERN DISTRIBUTION SYSTEMS

HERE COMES THE

Trumbull Train

OF ELECTRICAL PROGRESS

A whole parade of new Trumbull products is headed your way! A new advancement in the entire line of Trumbull products — Flex-A-Power systems, Panel Boards, Control Centers, Switches and Motor Starters — all radically different. So watch for Trumbull's new product announcements during 1949. Here's the first —



A NEW

Magnetic Motor Starter and Magnetic Contactor

New, from top to bottom, Trumbull Starters and Contactors in sizes 0, 1, 2, 3 give maximum protection to motors up to 50 hp, 440 v. Look at all their important new advantages:

LONGER CONTACT LIFE —

Actual factory tests show the silver contacts on the Trumbull starter "make and break" for millions of operations — many times more than any starter on the market.

EASY TO MAINTAIN —

Silver contacts have permanently attached springs that are easy to remove. Terminals are located on the front and are easy to wire — a screw driver is all you need to disassemble starter — can be accomplished in less than a minute.

EASY TO INSTALL AND SERVICE —

Note convenient knockouts, large terminals, front connections, and ample wiring space.

GREATER PROTECTION —

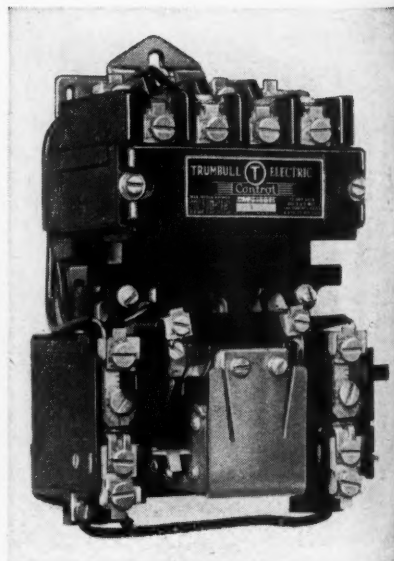
Bi-metallic relay heaters follow motor's heating curve. Easily adjusted for automatic or manual reset.

BUILT TO LAST —

All parts resist corrosion and moisture. Examine plastic coil enclosure to see how the tough varnish impregnation protects windings. Contact points and cold-molded asbestos arc hood eliminate arcing . . . give clean "make and break" contact.

QUIET OPERATION —

Permanent lubricant impregnated in the plastic coil enclosure keeps magnet guides sliding smoothly . . . eliminates low voltage "chatter."



FOR MORE INFORMATION about this latest Trumbull development, write for Circular TEC 11. **THE TRUMBULL ELECTRIC MANUFACTURING CO.**, Plainville, Conn. Other factories and offices throughout the United States. Foreign representation.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL  ELECTRIC



TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

at least

BUILDING WIRE THAT LASTS LONGER, PULLS EASIER, SAVES MONEY

...Thanks to

TRIANGLE'S

new braid of

GLAZON



For EXTRA value—at NO extra cost—Insist on "GLAZON"



What "GLAZON" is:

"Glazon" is a tougher, more flexible, longer-lasting braid that combines the desirable properties of an inorganic substance derived from glass with those of special saturants to achieve a new high in safety and durability under the most adverse conditions. This new protective covering gives:

LONGER LIFE. Conductors and insulation are doubly protected by a stronger, tougher, more impervious and more durable covering than heretofore possible.

SMALLER DIAMETER. Braid, although stronger, is considerably thinner. Strands lie flatter, clasp insulation tighter, absorb less saturant—reducing diameter.

GREATER FLEXIBILITY. Less bulk and greater elasticity of the braid increase flexibility.

SMOOTHER SURFACE. Uniformity of fiber and tighter lays eliminate the uneven surface common to many braided coverings.

GREATER RESISTANCE to the destructive elements of man and nature: water, heat, oil, acid, corrosive fumes, fungus, rodents, sunlight, freezing, rotting.

IMPROVED FISHABILITY. "Glazon" covered wire can be snaked through longer conduits, around sharper bends, easier, quicker, than any other type.

EVEN SURFACE, free from bumps and ridges, slides easier.

SMALLER DIAMETER saves space, makes it twice as easy to snake in "that last one."

SMOOTH FINISH prevents sticking, reduces friction on long runs and around sharp bends.

TOUGH COVERING resists impact and abrasion.

GREATER FLEXIBILITY saves time in wiring every junction box, switch box, outlet box.

Costs No More—Yet Saves At Every Step of the Wiring Job

Available in sizes from No. 14 through No. 6 AWG with solid or stranded conductor. Types R, RH, RW.

If It's "GLAZON" It's Made by TRIANGLE . . .
If It's Made by TRIANGLE It MUST Be Right!

For full details, contact your nearest Triangle jobber, or write

TRIANGLE CONDUIT & CABLE CO., INC.

1908 Jersey Avenue, New Brunswick, N. J.



BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES RIGID CONDUIT • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

NEVER BEFORE!

A G-E General-Purpose* Insulating Varnish

WITH THESE
OUTSTANDING CHARACTERISTICS

G.E.'s new 9574

MAKE YOUR MOTOR REPAIRS
EASIER, MORE EFFICIENT BY
USING G-E 9574!

Get more information on this remarkable general-purpose insulating varnish. New bulletin gives you full details. Just write to your local G-E Distributor or Chemical Department, General Electric Company, Pittsfield, Mass.



EXCELLENT BONDING STRENGTH

General-purpose 9574 has excellent bonding properties. It is ideal for all types of motor windings (except extra high-speed armatures), and has outstanding electrical characteristics.



EASIER TO WORK

G-E 9574 is a phenolic drying-oil varnish. It's particularly easy to use and handle. It has an unusually high flash point (100 F), and its viscosity (250 C. P. average at 45 F) makes it usable at barrel gravity.



NO SPECIAL THINNERS REQUIRED

G-E 9574 can be thinned with ordinary petroleum spirits up to 20%.



CURES AT LOW TEMPERATURES

This **clear-baking varnish** cures at low temperatures. A baking cycle as low as 212 F is successful in conventional baking equipment.



PENETRATES DEEPEST COILS

G-E 9574 easily penetrates the deepest coils, forms an even film. Aging properties are excellent.

*G-E 9574 gives excellent results on all types of coils except extra high-speed armatures.

You Can Put Your Confidence in

GENERAL  ELECTRIC

MAKE SURE OF *Longer-Lasting.* *more Dependable Protection* *in your Panel boards*

...ALWAYS SPECIFY I-T-E TYPE ET THERMAL CIRCUIT BREAKERS

ALL panelboard circuit breakers may look alike, but only the I-T-E type ET breakers offer you the more rugged construction, the more dependable operation of breakers designed and built by *Switchgear Specialists*.

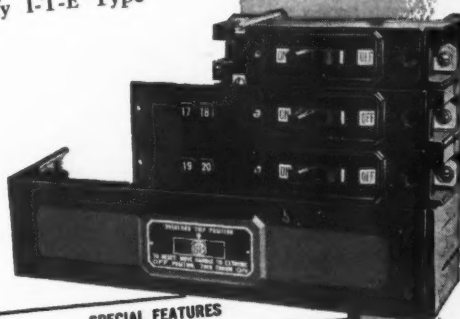
Longer lasting? You bet! All metal parts of type ET breakers are stronger, heavier; they stand up longer under constant use. Higher contact pressures — up to 25% higher — mean that contact temperatures and resistances

are kept to a minimum; contacts have less tendency to oxidize; operate effectively, longer.

And type ET breakers are *dependable*. Exclusive I-T-E thermal elements operate at high temperature rise; keeping derating factors to an absolute minimum.

Next time you need a panelboard, remember this: for longer lasting, more dependable, *more efficient* circuit breaker protection, always specify I-T-E Type ET thermal breakers.

Complete information on I-T-E type ET thermal breakers is contained in catalog 5003. Send for it today. I-T-E will be glad to supply you with the names of panelboard builders in your locality who will furnish panelboards equipped with I-T-E type ET circuit breakers.



I-T-E TYPE ET BREAKERS

| I-T-E TYPE ET BREAKERS | | | | | | | | | | SPECIAL FEATURES | | | | | | | | | | | | | |
|--|----------------|--------------------------------------|--------------------------------------|--|-----------------|---------------------------|-----------------|----------------------------------|-------------------|------------------|---|---|---|---|---------------|--|--------------------|----------------|------------|-------------------|----------------------|---------------------|---------------|
| TYPE CIRCUIT BREAKER | AMPERE RATINGS | VOLTAGE RATINGS | | UNDERWRITE'S LABORATORIES INTERRUPTING RATINGS | | NEMA INTERRUPTING RATINGS | | QUICK MAKE QUICK BREAK MECHANISM | STANDARD FEATURES | | | | | | NON AUTOMATIC | THERMAL AND NON-ADJUSTABLE MAGNETIC TRIP | AUXILIARY SWITCHES | ALARM SWITCHES | SHUNT TRIP | LINE VOLTAGE TRIP | MECHANICAL INTERLOCK | CENTER TAPPED STUDS | DRAWOUT STUDS |
| | | AC | DC | AC | DC | AC | DC | | TYPE OF TRIP | | | | | | | | | | | | | | |
| PANELBOARD AND INDIVIDUAL MOUNTING 1, 2 & 3 POLE | 10-50 | (1 POLE) 125/250 (2 & 3 POLE) 250 | (1 POLE) 125/250 (2 & 3 POLE) 250 | 5,000 | 5,000 | 5,000 | 5,000 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 100 AMP. FRAME NON-INTERCHANGEABLE TRIP 2 & 3 POLE | 10-100 | 250 600 | 125/250 250 | 5,000 10,000 | 5,000 10,000 | 5,000 15,000 | 5,000 10,000 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 100 AMP. FRAME INTERCHANGEABLE TRIP 2 & 3 POLE | 50-100 | 250 600 | 125/250 250 | • | • | 5,000 15,000 | 5,000 10,000 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 225 AMP FRAME 2 & 3 POLE | 70-225 | 250 600 | 125/250 250 | 10,000 | 10,000 | 15,000 | 10,000 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| 600 AMP FRAME 2 & 3 POLE | 125-600 | 250 600 | 125/250 250 | 10,000 | 10,000 | 25,000 | 20,000 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | | | | | | | | | | | | | | | | | | | | | | | |

THERMAL CIRCUIT BREAKERS

The Leader In Technical Excellence



I-T-E CIRCUIT BREAKER CO., 19TH & HAMILTON STREETS, PHILADELPHIA 30, PA.—31 OFFICES IN UNITED STATES—IN CANADA, I-T-E IS EASTERN POWER DEVICES LTD., TORONTO

Switchgear • Unit Substations • Isolated Phase Bus Structures • Automatic Reclosing Circuit Breakers • Resistors • Special Products ORGANIZATION
• FOR POWER SWITCHING EQUIPMENT, REFER TO RAILWAY AND INDUSTRIAL ENGINEERING CO., AN I-T-E

HOME AND  FARM WIRING
MADE EASIER WITH

RoFlex

ROME'S NEW NON-METALLIC SHEATHED CABLE

On your next wiring job you will do well to specify and install RoFlex. It will save you time . . . and installation costs.

Further, this new Rome Cable product is designed and manufactured for long-time dependable service . . . a quality product for a quality job.

The man on the job will find RoFlex is easy to strip . . . smaller in diameter . . . lighter in weight . . . cleaner to handle. It's what the electrician calls "easy to work."

Here's why . . .

1. The thermoplastic insulated conductors strip easily leaving bright, clean copper for quick connection. The insulation is highly resistant to oils, acids, moisture, flame . . . is permanently colored for quick and easy circuit identification.
2. A spiral wrap of specially treated paper covering each conductor provides light-weight, durable protection against mechanical injury . . . yet, strips back easily.
3. Impregnated jute fillers in each valley give the finished cable increased longitudinal strength, and serve as "rip-cord" for stripping outer braid.
4. The outer cotton braid is flame and moisture resistant. The uniformly small diameter saves space in outlet boxes and fits smaller holes.

Yes, there's three way satisfaction when you standardize on RoFlex . . . a job well done . . . a satisfied customer . . . low cost installation. Make sure that your supply of RoFlex is adequate for your needs.

FOR YOUR NEXT "FLEX" JOB . . . INSIST UPON ROFLEX



EASY TO STRIP



SMALLER IN DIAMETER



LIGHTER IN WEIGHT



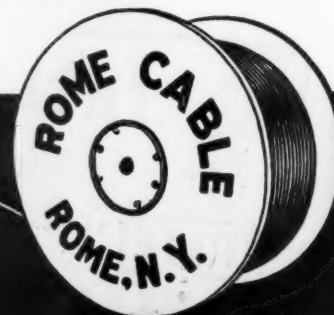
CLEANER TO HANDLE



Underwriters' approved
for 60° C operation under
the 1947 National
Electrical Code.

FROM BAR TO FINISHED WIRE

ROME CABLE
CORPORATION
ROME • NEW YORK



FEBRUARY at a Glance

Television Antennas

Television antennas and antenna systems require expert installation. Many of the problems are those of secure fastenings and workmanlike cable installation. However, there are additional problems peculiar to the electrical characteristics of television frequencies. In an important and timely article, Ira Kamen, manager of the RCA Television Department, Commercial Radio Sound Corporation of New York City, discusses the know-how of competent installation methods in his article beginning on page 76 in this issue.

Hospital Wiring

More than 500 hospitals are due to be built in the next few years under the current billion-dollar Federal Aid Civilian Hospital Program. Modern hospitals require special electrical facilities together with well-designed power and lighting systems. Since many of the new hospitals to be built under the program are to be located in non-urban areas, the U. S. Public Health Service has drawn up a recommended specification which "spells out" the major features of the electrical specification. Because of the importance of the project and the vital role that electrical facilities play in modern hospitals, we are presenting,

beginning on page 88, the complete text of this basic electrical specification for electrical service in the general hospital.

Outdoor Theatres

In trade jargon, the drive-in theatre is called an "ozoner". Most of us are familiar with these unusual theatres with the great screen rising in front of a large parking area. Electrical problems, however, are far removed from those of conventional theatre construction. George B. Stone, Manager of the Pacific Electrical and Mechanical Company of Los Angeles, gives us an inside view of the wiring job, out of his long experienced with drive-in theatre projects.

Motor Repair Abroad

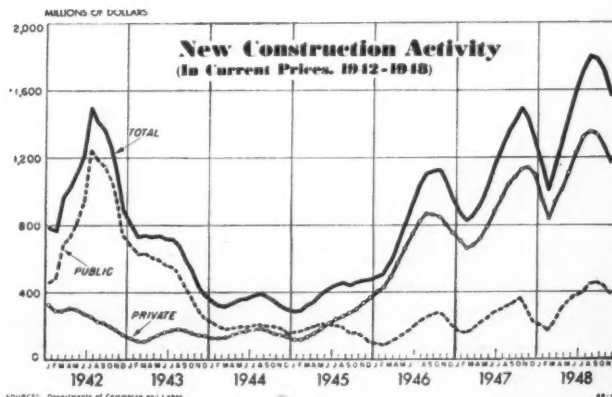
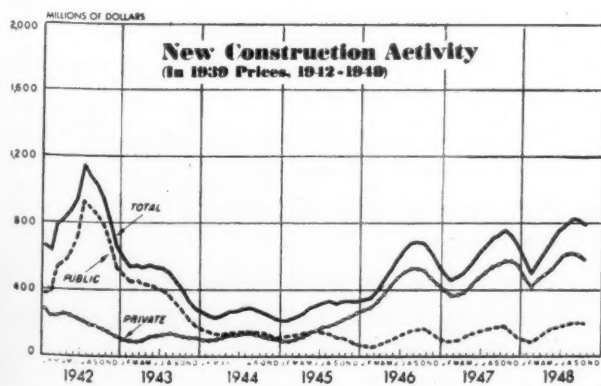
Motor repair practices in Britain are closely parallel with those in this country. Motor shops there have many of the same job problems and are inclined to be quite as ingenious in organizing job procedures and paper work. For a close up of a British motor repair firm, we are indebted to Mr. William E. Steward, of William E. Steward and Company, Limited, London, for "Methods From a London Shop", beginning on page 86.

Code Procedure

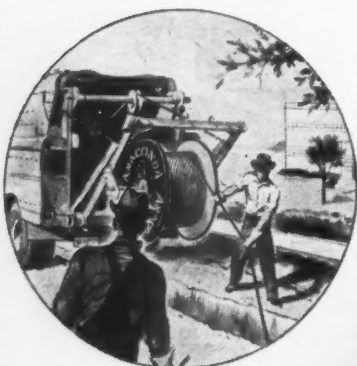
Since the Electrical Committee was dissolved last year, a new Coordinating Committee under NFPA has been reorganizing code-making procedures. New channels have been set up for code interpretation, amendments and revisions. Since the code is a fundamental part of wiring, the new procedures are of great importance to everyone concerned with electrical construction and installation. The new procedure, as announced by the coordinating committee, is presented substantially in full beginning on page 85.

Mass Production

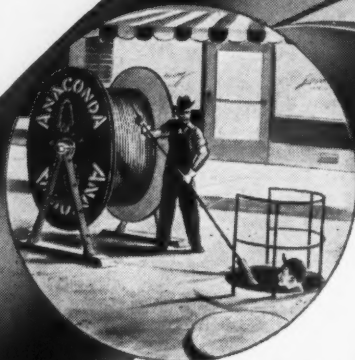
One of the great industrial plants of the postwar era is Ford's 87-acre Lincoln-Mercury assembly plant at Metuchen, New Jersey. With a long reputation for leadership in modern mass production techniques, the automotive industry offers a good example of modern industrial electrification. In this great new plant banked secondary radial distribution provides for power continuity; extensive electronic control and infra-red baking makes the electrical system an integral part of the manufacturing process. Details are given in our first "Outstanding Construction" article of this year, beginning on page 67, "Ford . . . of Metuchen."



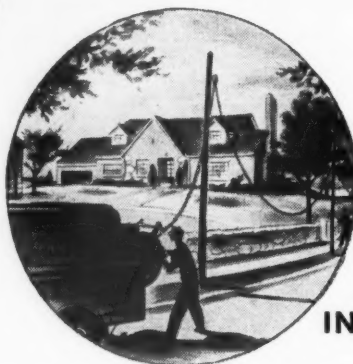
Durasheath



UNDERGROUND



IN CONDUIT



IN THE AIR

YOU'LL FIND IT

Everywhere

Versatility is one of the big advantages of Durasheath cable. You will find Durasheath used for power distribution between farm buildings, in street lighting systems, airports, mines, industrial plants, railroad signal systems and real estate developments. You will often find a single length of Durasheath in runs that are partly in conduit, directly in the ground and in the air.

For simplified, safer and more dependable power distribution systems, pick Anaconda's Durasheath—available in single and multi-conductor cables, to carry from 0 to 5,000 volts.

ADVANTAGES IN DURASHEATH:

No problems of electrolysis, corrosion and extremes in temperature.

Reduced weight. Can be used on short aerial spans without a messenger.

High resistance to abrasion, cutting, impact and flame.

Greater flexibility makes handling easier.

Resistance to oils, moisture, acids and alkalis generally found in the soil.

40410



ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4, N. Y.

RELAY SWITCHING

PRACTICAL DEVICES for operating one electrical circuit by means of a separate control circuit are as old as the telegraph relay. In power utilization manual switch operation on substantial loads is usually relegated to disconnect service. In principle and in practice, the load carrying conductors need not approach the operating station. In historical background, the new relay switch which provides for remote, low voltage switching of circuits and outlets in residences, is thoroughly sound.

THE INTRODUCTION of relay switching, however, has been launched with extraordinary caution. Activity is centered along the Pacific Coast. There is little experience with the new system east of the Rockies. But a revolution in wiring system design is quite clearly in the making. A new level of electrical convenience is available. A feature of enormous sales appeal is added to house wiring. Market opportunities are greatly widened. Yet there are no apparent signs of enthusiasm. Something is missing. It may be leadership.

HOUSE WIRING is ponderously conservative. Changes are absorbed slowly, even reluctantly. Bitter competition has made the field aggressively cost-conscious. Any new device which might introduce uncertainty in the cost pattern must overcome considerable inertia. And by and large, house wiring contractors are rarely organized to provide for the experimental jobs and field tests necessary to furnish cost data and know-how on new systems.

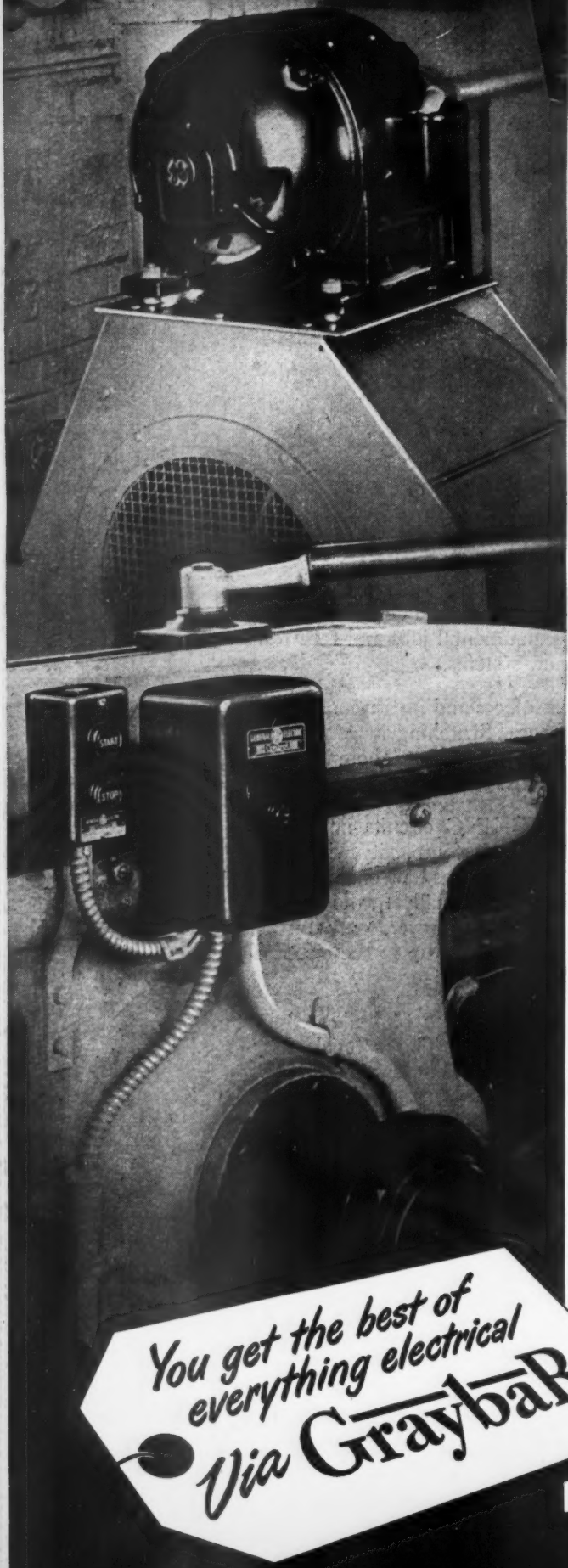
COMMERCIAL WORK in stores, offices and institutions offer a better opportunity than housing for initial experience. Switching in commercial work has become stereotyped and reduced to minimum essentials. There is a wide area for ingenious and useful relay control applications.

WHILE LOW VOLTAGE SWITCHING circuits imply easy installation and low cost to the layman, the added circuit complexity with small wires can have an entirely opposite connotation to experienced wiremen. Some of the materials, though attractive and compact, seem unusually fragile for permanent installations. Such aspects of relay switching, however, only further emphasize the substantial field experience that must be stored up in the electrical contracting industry before relay switching can realize its full potential.

A BACKLOG OF KNOW-HOW takes time to build. Relay switching is already being discussed in consumer publications. The materials, however, are not yet in wide national distribution, nor backed by the kind of intensive field engineering supervision by the manufacturers that seems essential for such a revolutionary and important product.

THE GROUND-WORK for relay switching will take more earnest and patient cooperation between contractors and manufacturers than any wiring development in recent history. And out of it will come many obvious, and probably as many unforeseen, advantages to the industry and to the public.

Wm. J. Stuart



POWER

EXACTLY AS YOU WANT IT!

Motors by G. E.

Whether you need a 5-hp motor for your plant or a 1/100-hp motor for your product, Graybar can provide the best one for the job. We distribute G-E motors, of which there are more in use than any other kind. That's because—AC or DC, general- or special-purpose—they deliver the power you want, smoothly and steadily. G-E "Tri-Clad" motors have extra protection against physical damage, electrical breakdown, and operating wear.

Magic Controls

Yes, they work almost like magic! There are proper G-E controls, distributed by Graybar, for making any motor obey your bidding. Even the smallest hand starter has a toggle that flips to mid-position, automatically shutting off the motor in case of overload. Magnetic starters, for remote or automatic control, are available in a range of types. Electronic "wizards" such as the Amplidyne can be supplied for special needs.

POWER SPECIALISTS

At principal Graybar locations, there are Power Apparatus Specialists who are expert in selecting and applying the right motors and controls for specific tasks. The nearest Specialist can help you or your electrical contractor, too, in planning the best use of transformers, switchgear, circuit breakers, capacitors, and other equipment for intra-plant power distribution.

Local Deliveries

Many motors and a range of controls are now available from stocks at Graybar warehouses throughout the nation. Your near-by Graybar Representative can supply full information about them—as well as myriad items for lighting, wiring, communication, and ventilation. Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y. 4844

IN OVER 100 PRINCIPAL CITIES



THIS 87-ACRE PLANT, latest unit to be completed in the \$75-million expansion and retooling program of the Ford Motor Company, raises Lincoln-Mercury assembly capacity to total of 300,000 cars a year.

FORD . . . OF METUCHEN

Huge new Lincoln-Mercury assembly plant at Metuchen, N. J., utilizes banked secondary radial distribution system for power continuity and extensive electronic control, high-cycle power tools, six miles of conveyors and infra-red baking tunnels for mass-production efficiency.

By Hugh P. Scott

AUTOMOTIVE evolution has been constant since the birth of that industry. But changes in engineering and design have been gradual rather than dramatically sudden. Rarely has a completely revamped car hit the market, with new body styles and accessories, new chassis and re-designed engine. In this postwar era, however, revolutionary revisions such as this are becoming the rule rather than the exception. With new conceptions of design, Kaiser-Frazer, Hudson, Studebaker, Cadillac, Oldsmobile and Lincoln revealed early trends towards streamlined simplicity. Yet public attention focussed particularly on the 1949 Mercury, for Mercury was the first completely redesigned medium-priced product to come from a Big Three plant. And, with the new Ford closely following Lincoln and

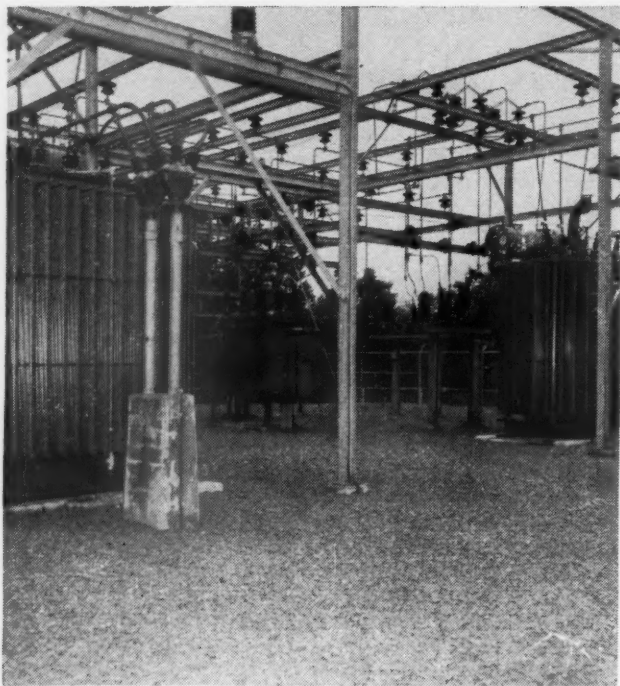
Mercury revisions, the Ford Motor Company became the first of the Big Three to introduce an entire new line of cars across the board, covering high, medium and low-priced fields. Spurred by returning competition, large-scale face-lifting jobs are likewise progressing behind locked gates of other manufacturers, and we may rightly expect continued employment, large-scale retooling and increased plant expansion—with emphasis placed upon efficient electrical distribution, control and application.

To mass-produce the new Mercury and Lincoln, \$50 million has already been invested in new tools and dies, while an additional \$25 million has gone into plant expansion to achieve production goals. New production lines have been constructed at Metuchen, N. J.; St. Louis, and Los Angeles. These three new plants, together with the Mercury line at River Rouge and the Detroit Lincoln line, will employ 12,000 people; will have a combined daily capacity of 1500 cars, and will probably assemble more than 300,000 cars during the present year.

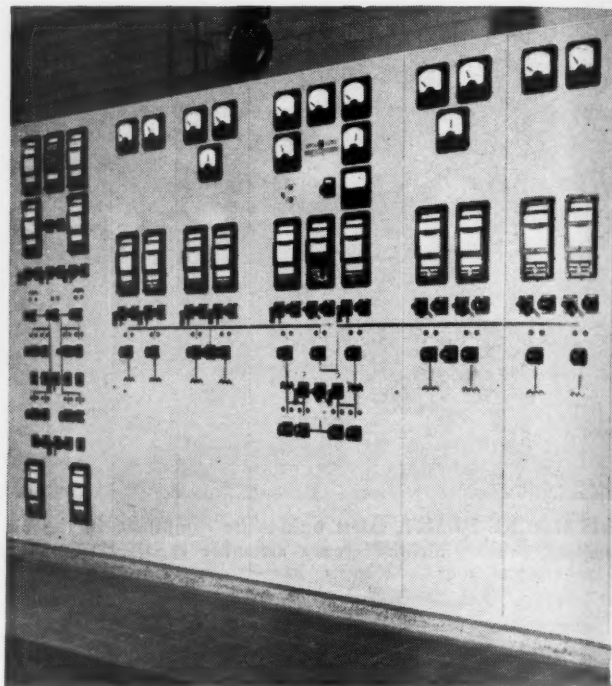
Constructed on an 87-acre site 40 miles southwest of metropolitan New York, the plant includes a main assembly building, office structure, auxiliary buildings for oils and boiler housing, a large test track, and parking facilities for 2500 cars. Construction is predominantly single-story, steel frame, brick and sash walls, with cement tile roof.

The main assembly plant, with 584,000 square feet of floor area, contains assembly facilities for 350 cars daily, an interior double-track railroad spur capable of accommodating 40 boxcars simultaneously, a moving 914-foot final assembly line and, at mezzanine level in the center of the plant, a modern cafeteria with seating arrangements for 600, and a complete hospital unit with modern operating rooms staffed by a full-time medical organization.

Outstanding Electrical Construction...



OUTDOOR SUBSTATION is served by three utility feeders carrying current at 26.4 kv. Current is stepped to 13.2 kv. for high tension primary distribution through two 6000/8000-kva., 3-phase, 60-cycle transformer banks.



DUPLEX CONTROL AND RELAY CENTER permits remote operation of entire primary distribution system from single location. Mimic chrome-strip bus diagram, lights, meters and recording charts furnish complete data to engineer.

HIGH TENSION DISTRIBUTION

To insure adequacy of capacity and continuity of service, primary power is delivered to the plant's remote outdoor substation at 26,400-volts from three New Jersey Power Company overhead lines, two of which are fed by Metuchen utility substations with the third line routed through neighboring Bound Brook. At this primary substation, current is initially stepped to 13.2-kilovolts for high-tension plant distribution through two outdoor 6000-8000-kva., 3-phase, 60-cycle transformer banks, delta-star connected, oil filled and air cooled, with automatic air blasts directed between radiator tubes to permit continuous overload ratings of the units.

With the exception of the overhead service lines, plant distribution between substations and all buildings is through an underground concrete-sheathed duct system, ducts normally being 4-inch fibre except beneath railroad sidings, roadways and similar locations where concentrated loads are developed. In such locations, ducts are of steel. Steel conduits and elbows also are used where ducts turn upwards through floor slabs at switching and local substation locations. All changes of direction in the underground system are at reinforced-concrete manholes, properly drained and equipped with wall conduit racks and pulling irons to facilitate proper handling and support for power feeders.

Supervisory control for the entire primary distribution and transformation system is from boards in the boiler house which is located immediately behind and adjacent to the assembly building. While the 13.2-kv. metal-clad switchgear and reactor, high tension bus assemblies, boiler

house 13,200-460-volt transformers, storage batteries and charging equipment for the 240-volt d-c control circuits are basement-based, remote operation is possible from a duplex control and relay center located on the ground floor directly above the switchgear vault.

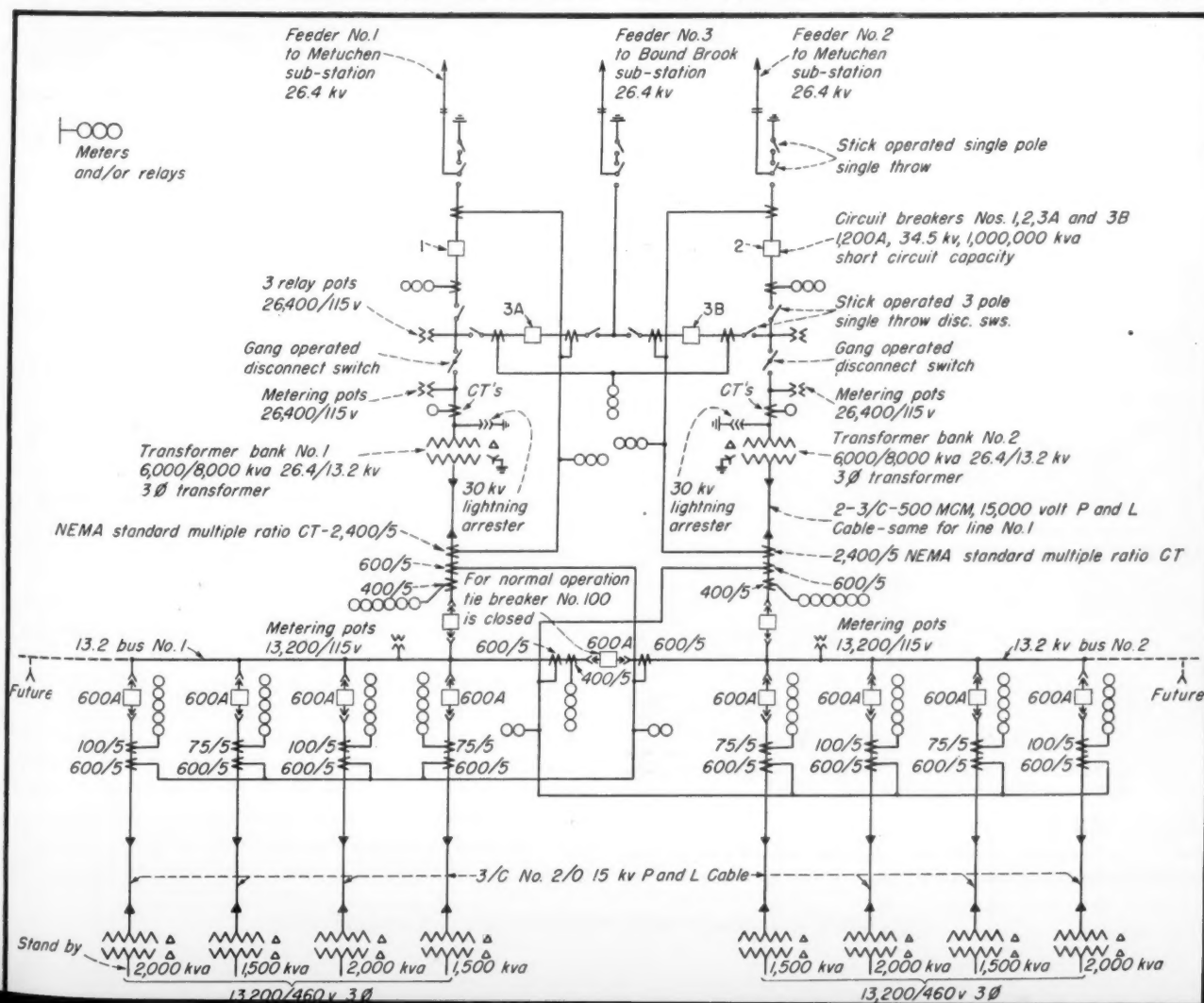
To eliminate control errors due to an inaccurate visualization of the electrical system, a mimic chrome-strip bus is mounted on the front of the main control board, presenting a single-line diagram of the entire primary installation. Series of red and white dim and bright indicating lamps, located in relative positions on this mimic bus, reveal existent conditions of the system at all times, while convenient switches, meters and charts provide means for control, and furnish complete operational data. Also included on the master board are tripping relays to safeguard equipment against overcurrent, low energy, inverse time, back-up and lock-out.

From the plant's huge substation to the main control center, and from this center to the individual 13200/460-volt substations located at principal load centers, primary underground distribution is through 3-conductor, 15-kilovolt, paper-insulated, lead covered and shielded cables with grounded neutrals.

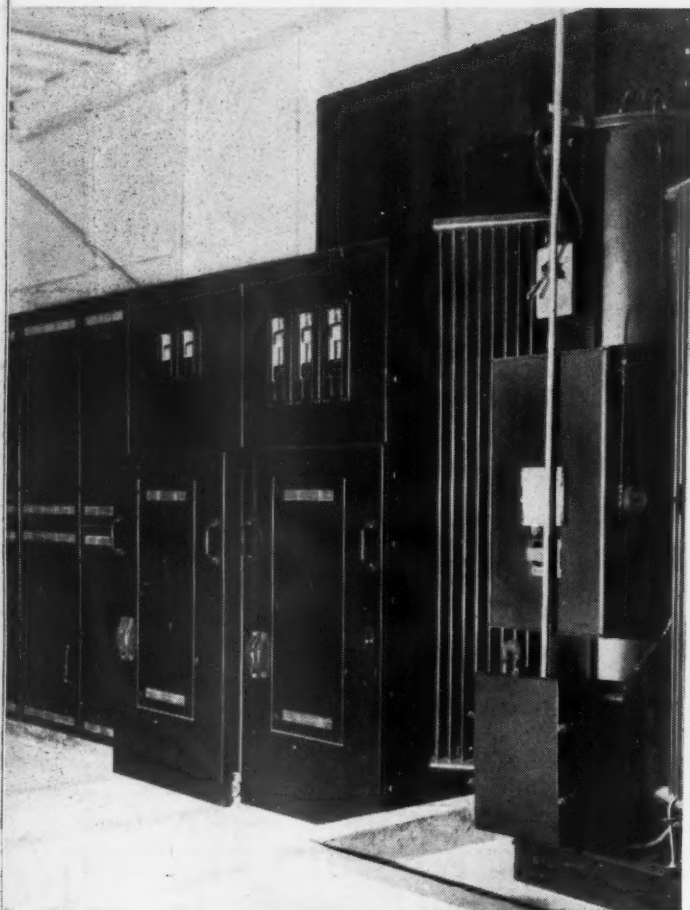
Primary circuit breakers on 26.4-kv. utility feeder lines and in the high-potential bus structure, are 34.5-kv. units with short circuit capacities for a million kilovolt-amperes.

The possibility of future expansion was considered in the selection of equipment for all key installations and this allowance for growth is noted in liberal feeders, oversized breakers and provisions in the various bus structures for the possible connection of additional feeders for extra 13200-460-volt 3-phase 60-cycle delta ungrounded transformer banks.

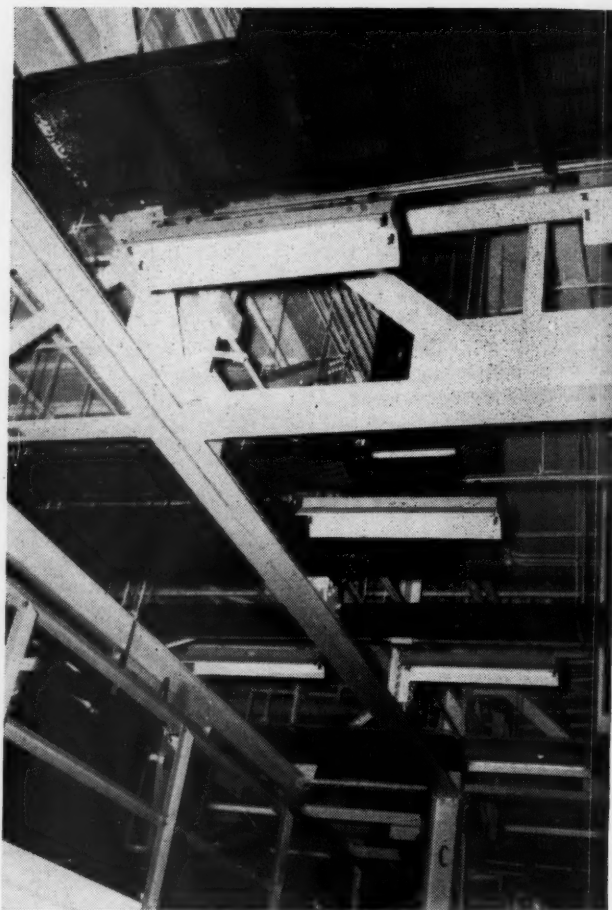
HIGH TENSION DISTRIBUTION SYSTEM includes two outdoor 26.4/13.2-kv. transformer banks, served by three utility overhead lines. Eight secondary transformers, located in three substations, step current to 460 volts for general plant power.



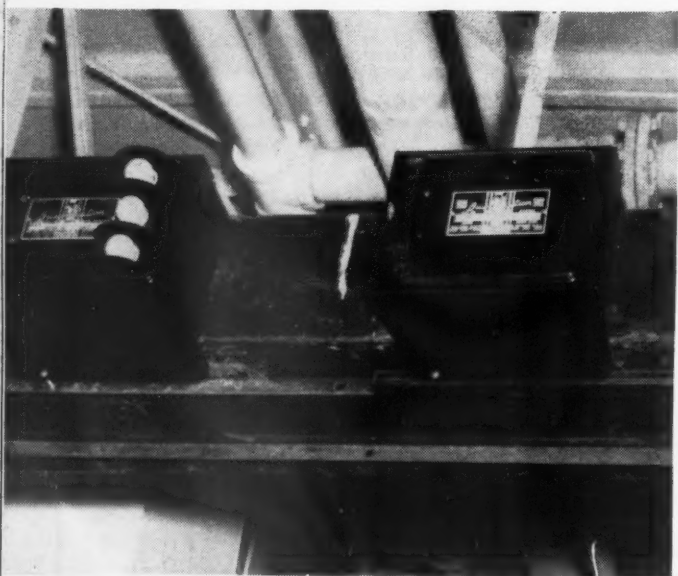
Outstanding Electrical Construction...



CONTROL PANEL AND TRANSFORMER steps 13.2-kv. current to 460-volt level. Each substation consists of transformer, busduct assembly, breakers, bus transition cubicle, feeder housings, controls, indicating and recording instruments.



LOW-IMPEDANCE BUSDUCT, installed above the lower chords of roof trusses, cross-connects secondary substations and feeds plug-in bus-runs. Feeder, tie and plug-in busduct for 460-volt distribution exceeds 7000 feet.



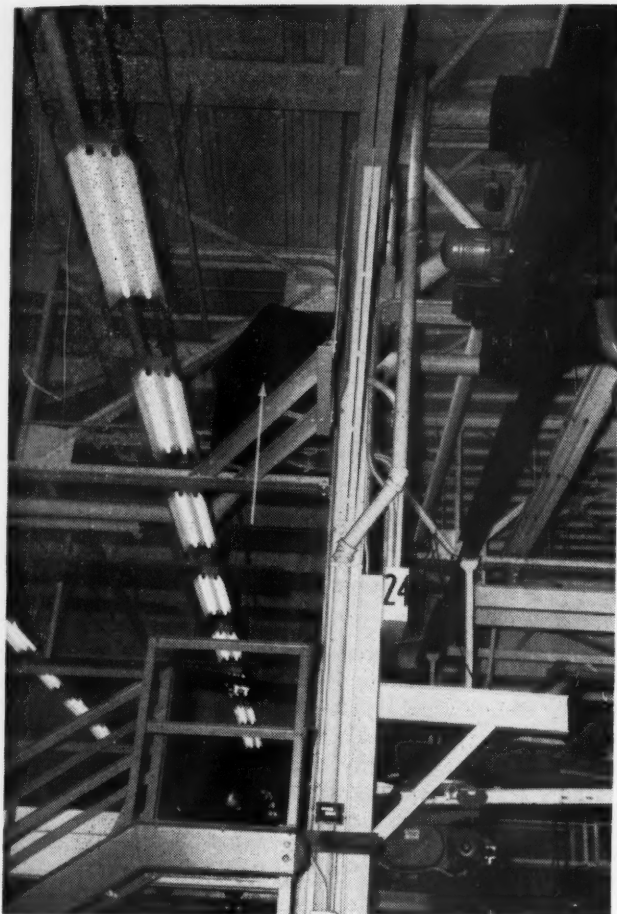
GROUND DETECTOR PLUGS establish a potential to ground between busbars and casings and also indicate ground on the busduct system.

SECONDARY SYSTEM

Secondary 13200-460-volt transformer units are eight in number, two located in the boiler house basement for local service in that area, with the remaining six being located in two three-unit substations constructed on the roof of the main assembly plant. Of the eight 13200-460-volt 3-phase 60-cycle delta-delta transformers, 4 are rated at 2000-kva. and 4 have 1500-kva capacities. Combined, the various substations include 8 complete bus assemblies, 38 metal-enclosed 600-volt heavy duty air circuit breakers, 4 fused housings having 8 removable 3000-amp. transformer breakers, 6 removable 3000-amp. tie breakers, 24 removable 1200-amp. feeder breakers, and 4 fused feeder housings. Also included are 36 capacitor units of 15-kva. each, totalling 540-kva., for power factor improvement on the 460-volt system.

Over 7000-feet of busduct is installed in the 460-volt distribution system; including a 640-foot 3000-amp. low-impedance bus tie between the two 3-unit transformer stations on the assembly plant roof, over 2100-feet of 1350-amp. Lo-X feeders, and more than 4200-feet of plug-in busduct. In addition to connecting plug-in bus-duct to substations,

... Ford of Metuchen



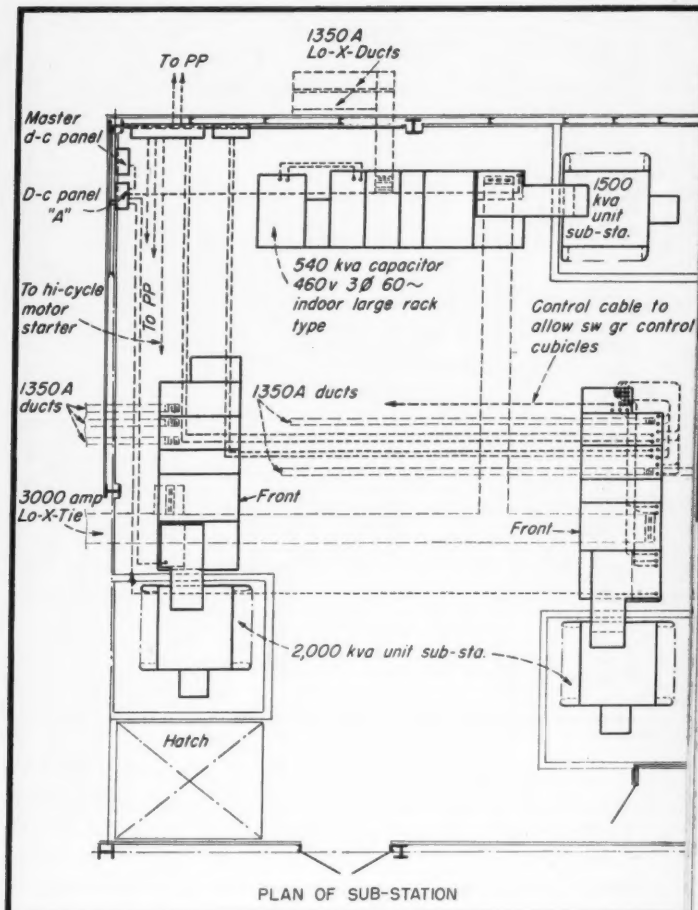
DRY TYPE TRANSFORMER (arrow) for cranes, service units and lighting are mounted on specially-designed platforms at roof-truss level adjacent to columns. Narrow column panels are positioned directly below.

the 460-volt feeders extend from transformer stations directly to power panels, fan rooms, capacitors, transposition boxes, infra-red lamp tunnels, air circulators, lighting transformers, high-cycle m-g sets and welding bus-runs.

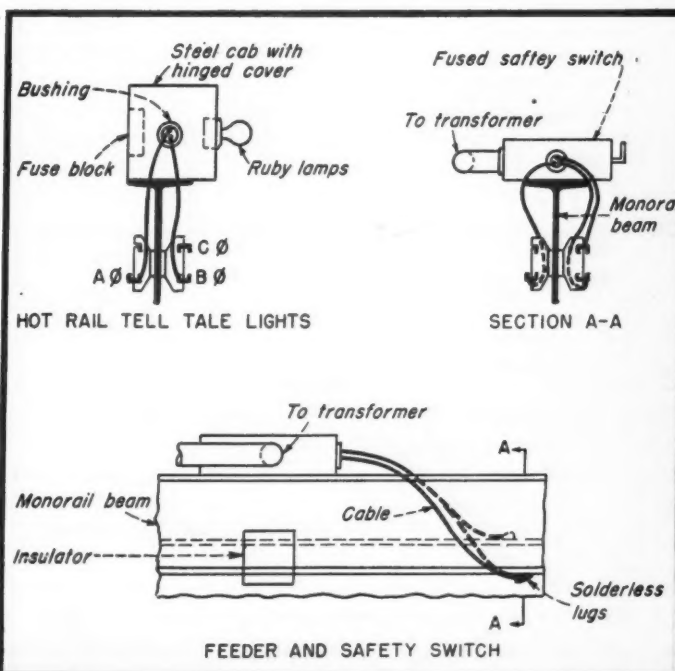
At lower voltage levels, elevators, the considerable kitchen equipment, many motor-driven service units, and the 20-ton crane spanning the railroad siding are operated at 240-volts, with individual areas fed by separate air-cooled transformers, wiring, controls and accessories.

In addition to underground fiber duct, feeder duct, plug-in busduct, Trol-E-Duct and both rigid and flexible metal conduit, wiring is carried in metal raceways, floor trenches and (in the office building) multiple underfloor ducts for telephone and receptacle circuits with preset inserts on 24-inch centers. All secondary wiring is rated for 600-volts, no wire being smaller than 12 gauge and all wiring of 8-gauge or larger being braided. Building wire for dry locations is type SN, for wet locations it is type SNW and, for hot locations, the standard is type AVA. Depending upon location and purpose, service receptacles are single, duplex, explosion proof, straight plug or twist-lock.

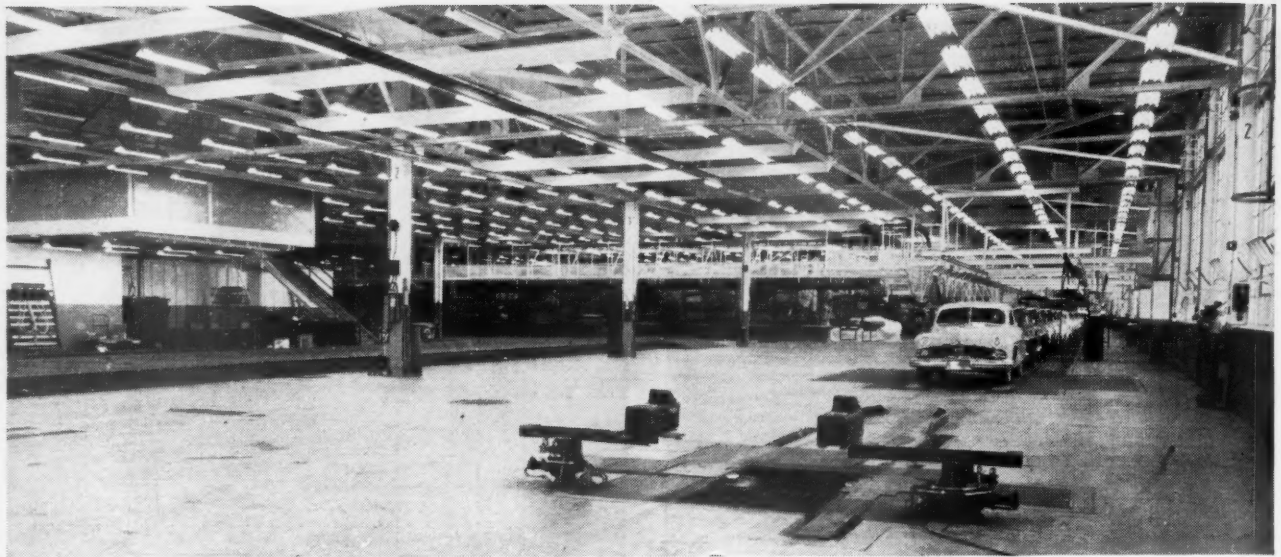
Also included in the complete electrical installation are separate circuits for fire alarms, signal systems, time clocks, card racks and electric clocks.



TYPICAL SUB-STATION, two of which serve main assembly plant, contains three transformers with total capacity of 5500 kva. Low-impedance busduct connects the two plant substations and also feeds extensive plug-in distribution system.



Outstanding Electrical Construction...



FLUORESCENT LIGHTING UNITS, representing over 1.5 million watts of connected load, are chain-suspended from 5 miles of trolley duct. Lighting panels are dead-front narrow-column with air-cooled transformers located directly above.

ILLUMINATION

The lighting load is satisfied by 36 air-cooled 480-120-208-volt, 3-phase, 4-wire, grounded neutral, 60-cycle transformers ranging in ratings from 15 to 75-kva., and having a total capacity of 1622.5-kva. Lighting transformers are strategically mounted in the assembly building, kitchen, cafeteria, parking lots, office building, garage and oil house. Throughout the assembly plant, these transformers are supported in the roof trusses directly above lighting panels.

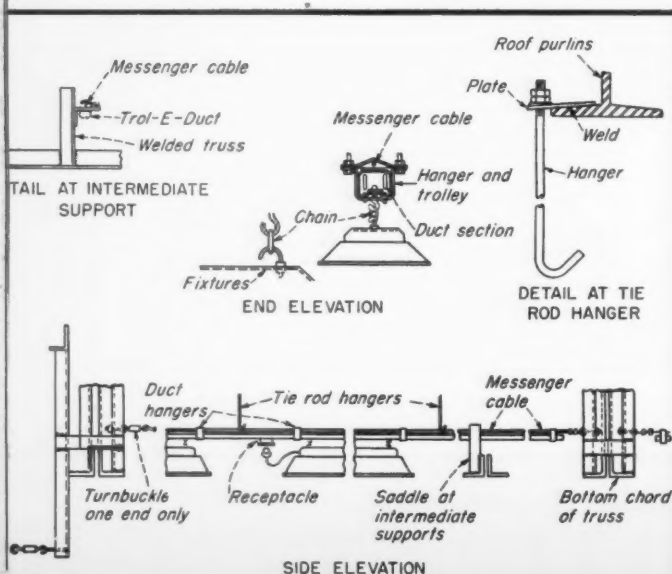
Lighting panels, 30 in all, are dead-front and predominantly narrow column types with wireways and neutral junction boxes located directly above. Circuit breakers are thermally operated, mainly rated for 50-amp. loading. A total lighting load of approximately 1,000,000 watts is carried on 436 connected circuits, while 155 spare breakers provide for ample plant expansion or rearrangement.

Throughout the plant assembly areas, illumination is almost exclusively fluorescent, units being fitted with both

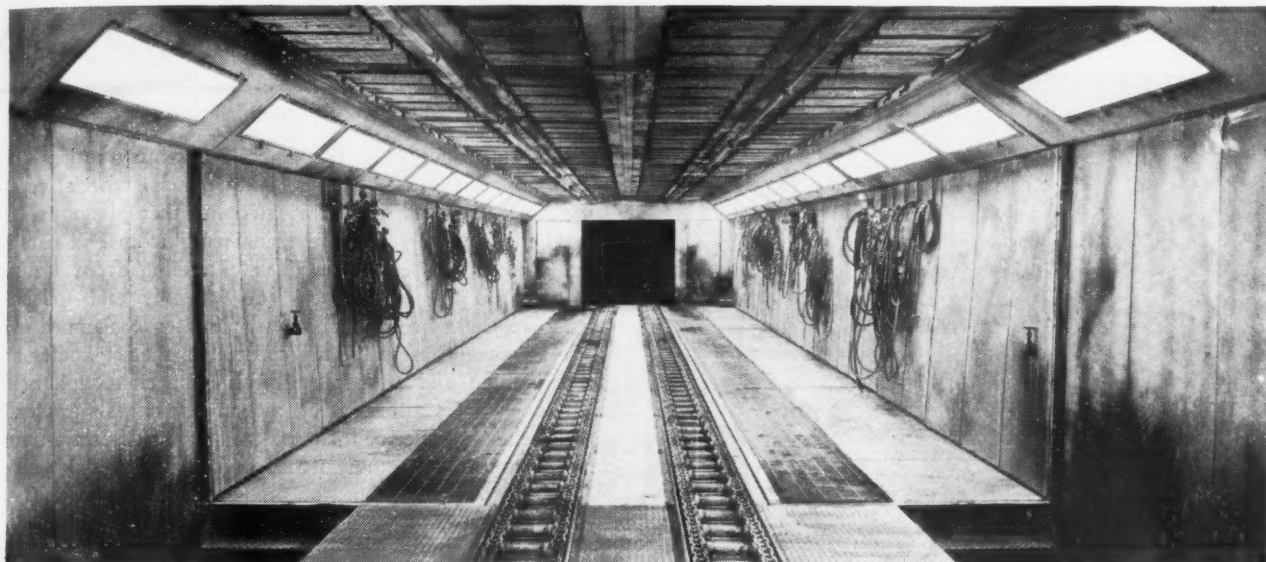
commercial and industrial type reflectors mounting from one to four 40-watt lamps depending upon mounting heights, spacing of units, and lighting intensities desired for specific assembly operations. To support these fixtures and to provide spacing flexibility, units are chain-suspended from parallel runs of Trol-E-Duct, over 5 miles of Trol-E-Duct being installed in the assembly plant for this purpose. Duct runs are, in turn, suspended by messenger cable runs terminating at turn-buckle anchors attached to lower flanges of roof-truss chords. Messenger cable spans are limited to 160-feet in length. Typical clearances in the assembly plant, from floor to lighting fixtures, are 14.5 feet. These clearances vary in crane bays where they are greater, and beneath mezzanine supports where they are slightly reduced. Above the fixtures and supported by roof trusses, distribution ducts are mounted at elevations of 16 feet while the elevation of the substation-supporting roof is 23-feet 9-inches. In sections of the plant other than assembly areas, such as in the office, hospital and cafeteria areas, fluorescent fixtures are installed either singly or in continuous runs, surface mounted or recessed into acoustical ceilings. Although general fluorescent illumination is primarily functional, decorative consideration has been combined with the architectural treatment of the main lobby where 4-row cove lighting has been utilized to indirectly illuminate the sweeping ceiling which descends from a top height of 14-feet above the front entrance to an 8.5-foot elevation over the interior doorway leading to office corridors and mezzanine stairways.

Incandescent lamps are utilized for high-intensity illumination for critical inspection and assembly work. They are also housed in explosion-proof fixtures in the oil house, air-intake chamber and similar hazardous areas. They are separately circuited for exit lights and night-lighting units, and they are mounted in outdoor flood-lighting as-

DETAILS FOR FIXTURE INSTALLATION in main assembly plant indicate methods for supporting messenger cables between roof trusses, mounting current-carrying trolley duct sections, and suspending two-lamp industrial fluorescent lighting fixtures.



... Ford of Metuchen



INTERIOR OF TYPICAL SPRAY BOOTH is lighted by vapor-proof fluorescent installation. Cars move slowly along platform conveyor while ceiling-recessed blowers and sub-floor high-capacity exhaust ducts reduce excess paint vapor to a minimum.



ANGLE MOUNTING OF LUMINAIRES and reduced mounting heights direct high-intensity illumination towards cars in areas where critical inspection is essential. Photo also shows intersection of two conveyor systems with electrical interlocks for safety of both cars and personnel.



ILLUMINATED EXTERIOR SIGNS are roof-mounted at either end of the plant and groupings of 1000-watt incandescent floodlights are positioned above window-washing trolley beams to illuminate landscaped grounds. Ground-positioned floodlights also direct light to buildings.

semblies on building exteriors, above parking areas and around the testing track for protective, decorative and utility purposes.

Modern utilization of light is also used for purposes other than illumination in areas devoted to assembly and testing. This is apparent by noting the application of photo-electric cells to operate protective interlocks, activate conveyors and accurately and rapidly orient headlights to conform with national highway safety regulations. By utilizing light in several forms, therefore, safety to personnel and to cars in

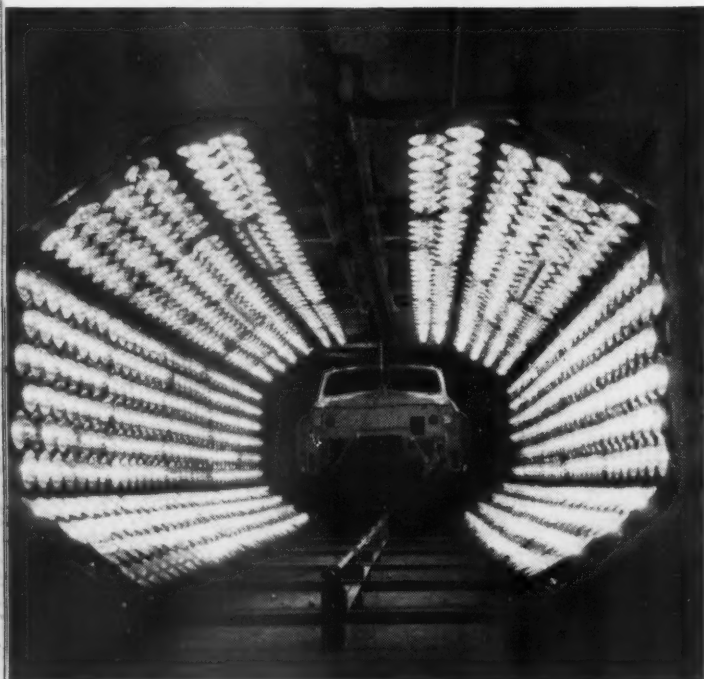
production is increased, glareless visibility is achieved and baking cycles are speeded through the huge infra-red ovens where priming and finishing coats of selected enamels are bonded to the cars.

With emphasis placed definitely upon a reliable electrical distribution system, accurate control, high-level illumination and maximum utilization of power tools and motorized equipment, Ford is again repeating the miracle of top-flight industrial production—production based squarely upon electrical know-how.

ELECTRICAL APPLICATIONS



FIRST NEW 1949 MERCURY to roll from the Metuchen assembly line is critically inspected by plant engineer R. J. Neville (hand on tire) and group of foremen. Prior to final assembly. . . .



INFRARED BAKING OVEN, containing 3700 heating lamps, bakes body enamels with tunnel temperatures at 300 degrees. Body panels, shipped to Metuchen from other plants, are unified by

Since the function of the plant is assembly rather than manufacture, engines, chassis, body panels, wheels, accessory parts and materials fabricated in other plants are received by rail daily and are transferred from box cars to parallel overhead conveyor lines extending from loading platforms to the many local sub-assembly and finishing areas. In these bee-hive sections, panels are clamped over body bucks and welded into completed shells; bodies are spray-painted and baked; engines, front ends, upholstery and wheels are readied in separate areas; chassis gradually assume their distinctive forms as component parts are transferred from sub-assembly lines; and completely assembled vehicles slowly roll along the final line for inspection, testing and delivery.

Throughout the plant, electrical operation is predominant. Six miles of overhead and floor-flush conveyors crawl forward with parts and finished products, motorized cranes and hoists are in extensive use; baking of enamel is rushed in tremendous 3700-lamp infra-red oven-tunnels, welding units and power tools are numbered by the thousands; high-intensity illumination is provided for all exterior and interior areas; controls combine manual, automatic and electronic operation from both motor-based and remote stations; while kitchen, hospital, office and testing equipment is extensively electric.

Practical electrical installation and application methods are numerous. One example is the utilization of hot-rail tell-tale lights mounted at intervals along the monorail beam carrying trolley feeders for the traveling crane spanning the double-track railroad siding. Three tell-tale lights are used in all, each station connected to a different pair of phase trolleys. Steel hinged-cover enclosures, each mounting a 50-watt ruby lamp and a 30-amp. 2-pole 250-volt fuse-block, are fastened above the monorail beam. Lamps remain lighted so long as conditions remain normal but, should a ground develop whereby any two phases are short circuited, the affected tell-tale lamp will go out, instantly notifying maintenance electricians on duty of the fault and location, permitting them to cut the power and repair the short before serious damage results.

Another practical installation is that of the electrical interlocking systems, used extensively along the various assembly lines to protect traveling products, equipment and personnel. For example, eight interlocks are installed in each paint spray tunnel where cars are raised, lowered and turned as they move forward. Should car bodies come in contact with any obstruction, these interlocks bring all motion to a standstill until the obstruction is located and removed. Also installed within spray booths are high capacity exhaust ducts that draw excess paint vapors downwards into water-spray raceways. Vacuum is maintained at a high level so that adjacent cars in the tunnel, simultaneously being sprayed with different colors, are not marred by air-borne contrasting paint.

The use of blowers is widespread, for the greater portion of the air admitted to the plant is blower-forced through fibreglas filters to remove foreign particles, and through water screens to create proper humidity. Fans also are

... Ford of Metuchen

automatically activated to raise louvres of roof-mounted exhaust vents, vents closing by gravity when fans are off.

Still another utilization of blowers is at exterior entrances, where unit heaters are mounted to combat the infiltration of cold air during winter months. Electrically interlocked with these sliding doors, heaters and fans function only when doors are opened, and hot air is directed towards the openings to neutralize the cold inrush.

The construction of many Ford cranes is unique, and further illustrates practical industrial design and application. By combining the features of swing booms, monorail hoists and tandem-rail cranes, loads can be carried from boxcars to sub-assembly lines or can be shifted around individual assembly areas in any desired direction, and suspended, raised or lowered in any desired position.

In addition to electrical hoists, electrically controlled hydraulic lifts are practically employed; one example being a hydraulic lift which descends to the track level of the recessed railroad siding to permit the passage of cars, and rises to the level of the plant floor to permit bridging the depressed tracks when cars are not on the siding.

Moving into areas where hundreds of hand tools are in use, another practical method is discovered in the use of high-cycle current. Although voltage is regulated at 230, frequency is converted from 60 to 180 cycles by means of three high-cycle m-g sets located on platforms above the assembly areas. High-cycle distribution is carried to power tools through 17 panels, 124 connected circuits, separate junction boxes and extensive runs of Trol-E-Duct. In addition to increased tool speeds and the greater available power, tools are operative only at 180 cycles and personnel are thus discouraged from removing hand-operated equipment from intended locations in assembly areas.

Not only in assembly areas but throughout the plant, accent is upon electrical operation. This is emphasized, among other areas, in the kitchen, where motors and equipment total 20-hp. and 172-kw. of load. Included in this area are electrical dishwashers, stoves, baking ovens, mixers, broilers, donut machines, fryers, ranges, steam tables, refrigerators, drinking fountains, ice cream cabinets, toasters, coffee makers, compressors, glass and silver washers, garbage disposal units, potato peelers and flake-ice machines. Four power panels, single and 3-phase, 208/120-volt, 4-wire, control this equipment.

Throughout this modern assembly plant, progressive design, construction and installation know-how are combined through architectural craftsmanship, structural abilities and efficient electrical translation.

ARCHITECTS:

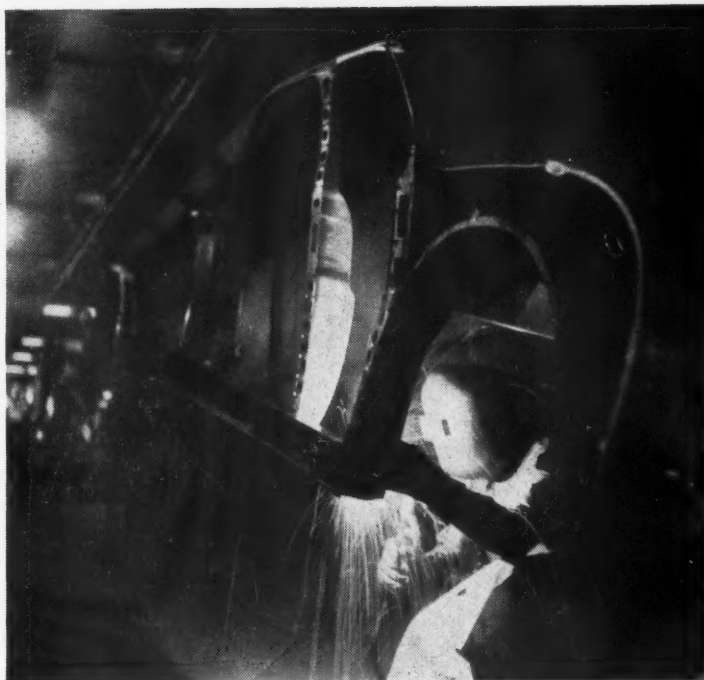
Albert Kahn Associated Architects and Engineers, Detroit, Mich.

GENERAL CONTRACTORS:

Wigton-Abbott Corporation, Plainfield, N. J.

ELECTRICAL CONTRACTORS:

Beach Electric Company, Newark, N. J., and Fischbach and Moore, New York City.

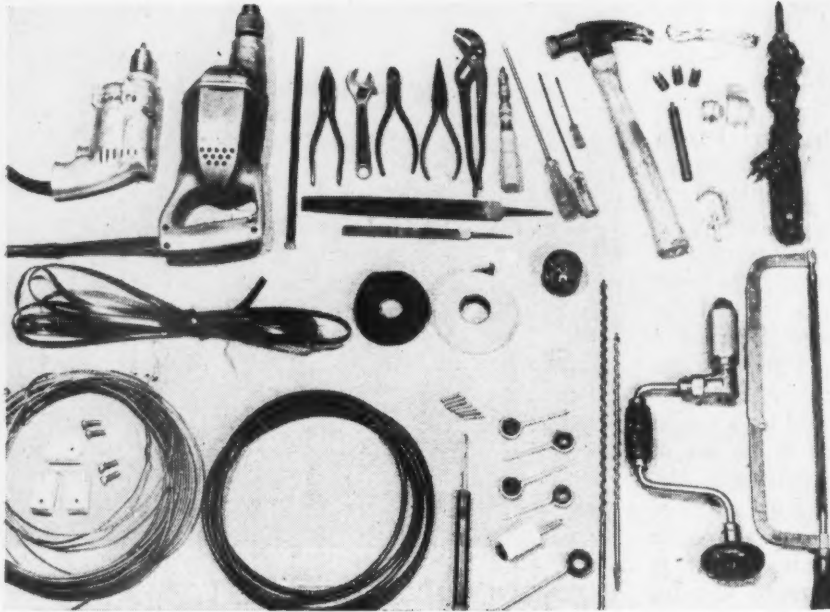


EXTENSIVE WELDING with segregated power feeders. Plant-wide emphasis is electrical, with conveyors, cranes, busduct and illumination aiding production. High-cycle feeders carry power for . . .



HIGH SPEED POWER TOOLS, suspended by safety balancers and operating from trolley duct circuits. Tool chucks carry variety of accessories to facilitate wide range of operations formerly done by hand.

TELEVISION ANTENNAS AND ANTENNA SYSTEMS



TOOLS, tapes, expansion sleeves, ground clamps, guy wires, coaxial cable, rawl plugs and screw eyes are included in the list of equipment and material required.

Competent workmanship, combining training with the selection of proper tools, is essential for a satisfactory installation of approved equipment.

By Ira Kamen

Manager, R.C.A. Television Antenna Department, Commercial Radio-Sound Corporation, New York City.

THE era of television no longer is on the way. It is here! And, reflecting this fact, many new multiple dwellings are being equipped with television outlets; including this facility with such standard services as plumbing, heating and lighting. With this growing acceptance, television is rapidly becoming an essential to residential living rather than being merely a desirable luxury, and television owners are depending more and more upon their television installations for entertainment. It is obvious, therefore, that television already is an integral part of the American pattern for gracious living. ("Television Antenna Systems", E. C. and M., June, 1947).

Since a satisfactory installation of a master antenna system in a multiple dwelling, or an individual antenna installation for a commercial establishment (restaurants, hotels and bars) depends upon trained, competent workmanship, this lusty new multi-million-dollar industry presents a wide field to installation contractors. To familiarize these men with the fundamentals of installation, this article will attempt to analyze these new techniques and

discuss the recommended tools involved.

While antennas used for individual television receivers and for master antenna systems may differ radically in design, the fundamental mechanics for installing the antennas are relatively constant. First to consider is the question of working tools. As indicated (above), the tools normally required approximately 20 in number, this total including:

Electric drill (slow speed) for $\frac{1}{2}$ -inch masonry drill bit (tungsten carbide)

Electric drill (high speed), for $\frac{1}{4}$ -inch drill bit

$\frac{1}{4}$ -inch star drill

Hand tools; such as hammer, hack saw, pliers, etc.

$\frac{1}{4}$ -20 Ackerman-Johnson lead expansion sleeves

Ackerman-Johnson tool

Antenna masts and ground clamps

Soldering iron and rosin core solder

Phosphor bronze guy wire and porcelain insulators

$\frac{1}{4}$ -inch bolts (galvanized or brass)

Coaxial cable

300-ohm twin lead

Rawl plugs and tools

Nailit knobs and insulated screw eyes

Wood brace and bits

Staples and tacks

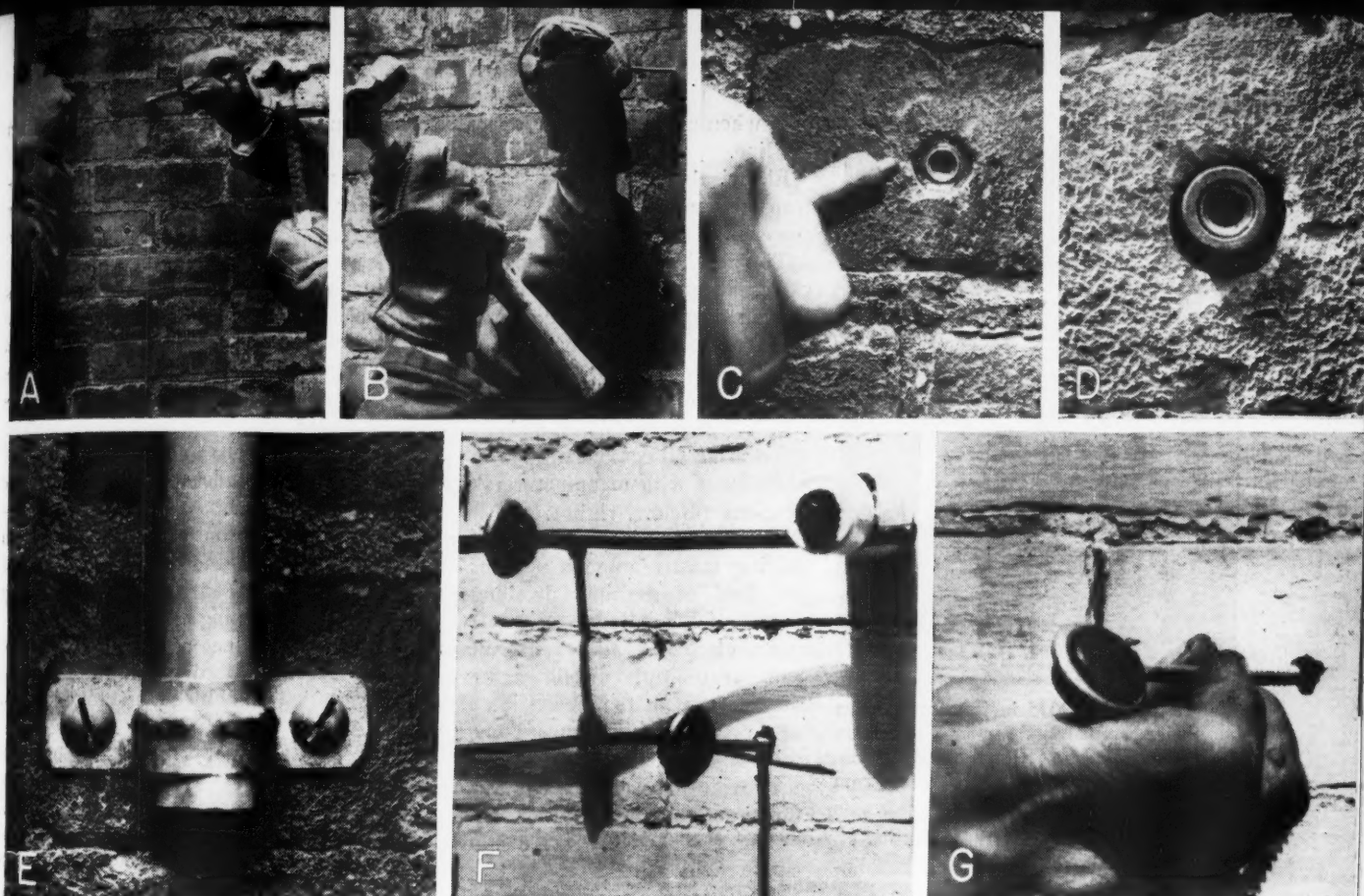
Friction and rubber tape.

While all of these tools are in common use, the exact list naturally will vary in accordance with the type of roof which may be of brick, wood, tile or slate.

Before mounting the antenna, survey engineers usually conduct tests before selecting a fixed position. For example; on apartment houses, roof parapets and elevator penthouses frequently are selected as the best locations for affixing bracket supports. ("Television Master Antenna Systems", E. C. and M., Jan., 1948).

After being definitely located by a television engineer, the antenna is installed by an electrical contractor in conformity with building codes and recommended practices.

When bracket supports are installed in common brick, holes should be drilled directly in the brick rather than into the cement between the bricks. Although drilling brick is harder than



BRACKET HOLES, located directly in the brick rather than the cement between bricks, are made by either rawl tools (a) or star drills (b). Lead expansion fitting, inserted in hole (c), is embedded securely (d) by hammering it with an expansion tool designed for the purpose. Bolt-held antenna clamps give firm support to metal masts (e). Coaxial cable and twin lead for receiver are supported by insulated screw eyes or nailit knobs (f) forced into rawl plug center (g), and unused groove of mallit knob is balanced by short stub of extra cable.

piercing the cement, the practice will eliminate the possibility of water leaks, crumbling of joints and the eventual loosening of brackets.

In using electric drills, an extension cord at least 200-feet in length should be available. It will then be possible to use accessible power outlets which are often several floors below the roof level in stairwells. In drilling, care should be exercised if the life of the masonry drill bit is to be prolonged and if the temper of the bit is to be protected against excessive heating. Bits are expensive items, and they may be protected through the practice of beginning a hole with a rawl tool (Fig. A). When the drill is finally used to complete the hole, binding, strains and overheating of the bit will be minimized.

When electric power is not available, a Star drill can be used to make the necessary holes. Experienced turning and hammering will produce holes comparable to those made by an electric drill but the work will naturally be slower and rougher with the mechanical tool. When a hole is completed, a 1-20 Ackerman-Johnson type lead ex-

pansion fitting should be inserted (Fig. C), after which the lead expansion sleeve is hammered to properly imbed it in the hole. Experience with the expansion tool will soon determine the amount of hammering required.

After fittings are installed in the brick, antenna mast clamps can be mounted with 1/4-inch bolts, and the antenna mast inserted through these clamps which can be selected to fit the particular type of mast being used. The mast is firmly secured by tightening the holding bolts (Fig. E). To assure a snug fit, rubber tape can be used as a gasket between clamp and mast and, where additional clearance is necessary, clamps may be fastened to brackets.

If it is necessary to extend the antenna mast, consideration should be given to the expected life of the installation and, in this connection, it is well to note that aluminum conduit masts, while costing slightly more than steel masts, have a far greater resistance to corrosion. But regardless of whether masts are of steel or aluminum, they should be grounded for lightning protection by means of bus wire

and ground clamps attached to either a water pipe or some other suitable earth ground located on the roof.

On individual television installations where contractors run coaxial cable without conduit, the coaxial cable or twin lead may be guided along the roof structure by means of nailit knobs or insulated screw eyes installed in the brick structure. It should be clearly understood that the 300-ohm twin lead transmission line, required for many individual television receivers, definitely *must not* be run in conduit.

Installation of knobs and screw eyes is accomplished by:

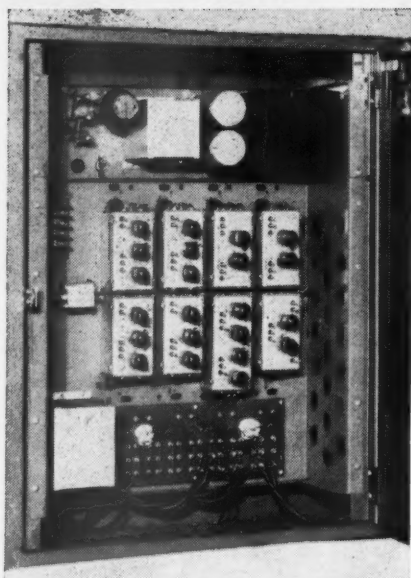
Piercing the brick with a rawl tool, working the tool by hand and hammer until sufficient depth is obtained;

Inserting the rawl plug into the hole;

Pushing the nailit knob or twisting the insulated screw eye into the rawl plug center (Fig. G); and

Fitting the coaxial cable through the nailit knob and finally tightening the knob. In the case of insulating screw eyes, coaxial cable or twin lead is pulled through the applicable fittings.

There are three fundamental ele-



INDIVIDUAL PADS in the antennaplex amplifier are installed for each television booster amplifier channel and are adjusted to compensate for the varying signal levels from the various transmitter stations.

ments in a television antenna installation: the antenna, transmission line, and television receiver.

The function of the antenna is to pick up transmitted signals which are relatively free from interference and reflections (so-called *ghosts*), and of sufficient strength to energize the television receiver. These antennas take various forms to provide the characteristics necessary to meet specific television installational requirements.

The function of the transmission line is to connect antenna with receiver. Two types of transmission cable are commonly employed; a balanced, inexpensive 300-ohm line with a very low attenuation, and an unbalanced 73-ohm coaxial line. This latter cable, being shielded and having a lower impedance, is preferred and standardized by many manufacturers of higher-priced television receivers because of its improved signal-to-noise ratio. But whether cables have resistances of either 300- or 73-ohms, the resistance must remain constant on all television channels.

Perhaps the most important factor in a television installation is the matching of receiver input with transmission line impedance for, when incoming signals are completely absorbed by the receiver, reflections are eliminated and there are no standing waves on the transmission line to mar the television pictures and attenuate the signal level. Antenna impedance is only important from the standpoint of power transfer, since maximum power is transferred

only when antenna impedance matches the line.

Electrical contractors installing transmission lines have several responsibilities, including:

To provide *new* certified coaxial cable, since much of the cable on the present surplus market does not conform to existing commercial standards;

To use only solid pieces of cable, totally free from splices, and

To make all coaxial fittings in exact accordance with manufacturers' specifications (Below, right).

Probably the largest market for installing master antenna systems is in the field of multiple dwellings and commercial buildings.

An electronic master antenna system for multiple dwellings, to merit the approval of the Television Broadcasters Association, must solve four problems:

Provide high quality television pictures on all television channels, and strong FM and AM signals over a single cable,

Minimize the effect of television receiver oscillator radiation,

Permit adjustment of a wide range of signal levels from television stations, and

Allow connection of television, AM and FM receivers to the system without altering the outlets for each type of receiver.

For example; the RCA Television FM-AM antennaplex system solves these problems in the following manner:

An individual directional array is installed for each television channel. By installing individual antennas, this system provides the best television signals receivable in the area, on each television channel. The FM antenna has a non-directional pick-up pattern which assures FM reception from all stations regardless of their direction with respect to the multiple dwelling. The AM whip antenna also has a non-directional pattern and picks up all AM standard broadcast stations transmitting in the area.

The effect of one television receiver upon another in the system is minimized by the isolation provided in the distribution transformers and individual outlets. There is a minimum isolation between any two outlets of 100,000 to 1, or 50 db. Even if one television receiver has a shorted input, it will not affect any other television receiver connected to the system.

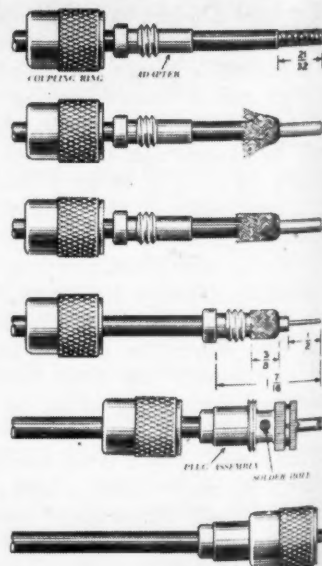
The antennaplex amplifier (upper left) has facilities for the installation

of individual pads for each television booster amplifier channel. These pads are adjusted by the installation engineer to compensate for the varying signal levels from each television transmitting station.

The television FM-AM outlet has been designed to fit the standard outlet box. The outlet has a coaxial receptacle for plug connection of television and FM receivers and a three-pronged polarized receptacle suitable for connection to any type of AM standard broadcast and short wave radio receiver. A special filter is installed in the outlet which permits an AM receiver and a television or FM receiver to operate simultaneously without effecting the other.

These outlines of recommended procedure are based upon the successful operation of many satisfactory installations.

Contractors installing systems of this type and working in cooperation with engineers representing R.C.A., train personnel in handling coaxial cable, fittings and television antennas in accordance with exacting requirements. For this new industry involves new techniques; solder guns have replaced soldering irons, and cables are now *guided* rather than *pulled* through conduit. To provide installation contractors with technical information and know-how is a service which manufacturers have willingly assumed and, with this guidance, the most complicated television installations can be completed safely, surely and with maximum effectiveness.



COAXIAL FITTINGS must be assembled and used in exact accordance with manufacturers' recommendations to insure guaranteed service from installation.

PROGRAM FOR THIRD INTERNATIONAL LIGHTING EXPOSITION AND CONFERENCE

March 29 through April 1, 1949, Stevens Hotel, Chicago

Tuesday, March 29 Conference Session

Chairman: L. E. Taylor, Pres., Illuminating Engineering Soc.

10:00 A. M.—"Y B in Dark?"

G. T. Morrow, Chairman, Exposition Operating Committee

10:03 A. M.—"New Light on Planned Lighting"

L. E. Taylor

10:15 A. M.—"One Interest: One Goal"—Welcoming Address

B. W. Clark, President, N.E.M.A.; Vice-Pres. Westinghouse Electric Corporation

11:00 A. M.—Presentation—Merit Awards

R. D. Bradley, Chairman, Merit Award Contest Committee

12:00 Noon—OFFICIAL OPENING

Third International Lighting Exposition

Wednesday, March 30 Conference Session

Chairman: D. M. Salsbury, Vice-President, N.E.W.A.; Pres., Westinghouse Electric Supply Company

10:00 A. M.—"The Wholesalers' Part in Lighting Sales"

D. M. Salsbury

10:15 A. M.—"Where Do Business and Lighting Go From Here?"

Eric Johnston, President, Motion Picture Association of America, Inc.

11:00 A. M.—"What the Lighting of the Future Will Mean to You"

A New Presentation and Demonstration by—
Lamp Department General Electric Co., Nela Park

8:30 P. M.—Exhibitors' Night—Grand Ballroom, Stevens Hotel

Entertainment—presented by the Exhibitors
(Admission by ticket only)

Thursday, March 31 Conference Session

Chairman: E. R. Acker, President, Edison Electric Institute; President, Central Hudson Gas & Electric Corp.

10:00 A. M.—"The Power Company's Part in Lighting Sales"

E. R. Acker

10:15 A. M.—"Why Atomic Energy Cannot Be Used As Power At This Time"

W. F. Davidson, Research Engineer, Consolidated Edison Company

11:00 A. M.—"Glass Comes of Age"

Lecture and Demonstration
H. G. Vogt, Research Physicist, Corning Glass Works

Friday, April 1 Conference Session

Chairman: R. W. McChesney, President, National Electrical Contractors Association; President, Harry Alexander, Inc.

10:00 A. M.—"The Contractors' Part in Lighting Sales"

R. W. McChesney

10:15 A. M.—"A Little Light on Color"

J. E. Garnsey, Colorist

11:00 A. M.—"Plastics, The New Look in Lighting"

F. W. Tetzlaff, Plastics Department, Rohm & Haas Company

New Light on Planned Lighting

Third International Lighting Show in Chicago
March 29 - April 1 will feature exhibits of new lighting developments and design and four conference sessions.

MEECA for all who are interested in lighting application, lighting progress, and the future of lighting is the Third International Lighting Exposition and Conferences, which are to be held in the Stevens Hotel, Chicago, March 29th through April 1, 1949. Sponsored by the Commercial and Industrial Lighting Equipment Section of the National Electrical Manufacturers Association, the four-day program is designed to put "New Light on Planned Lighting". Following the successful program patterns of the First and Second Lighting Expositions, there will be outstanding exhibits by leading lighting equipment manufacturers, many hundreds of Merit Award winning case studies in lighting application, and four outstanding conference sessions covering a broad

range of lighting topics and industry problems.

One Exposition highlight will be the presentation of Gold Seal and Merit Awards to the winners in the various classifications of the Merit Award Competition. This Competition covered Lighting Case Studies which were designed or installed during 1948. Contestants will include electrical contractors, utility lighting and power representatives, architects and consulting engineers, electrical wholesalers and their lighting specialists and salesmen, and owners and users of industrial and commercial lighting. The Award winning case studies, as well as all other submissions, will be on display throughout the Exposition period.

Lighting equipment and accessories

manufacturers will have on exhibit not only standard lighting products, but also many new lighting designs and developments which will be shown publicly at the Exposition for the first time. The exhibitors will feature the latest advances in Planned Lighting equipment for all lines of business—offices, stores, factories, schools, theatres, service stations, airports, play areas, laundries, etc.

During the conference sessions which begin on Tuesday, March 29, lighting authorities will reveal the latest developments in illumination technique, lighting trends, lighting progress, selling plans, and installation and maintenance techniques.

There will be an internationally known representative of American business on the Wednesday morning program. He is Eric Johnston, President, Motion Pictures Association of America, who was formerly President of the United States Chamber of Commerce. He has recently spent considerable time in Europe studying the international situation, and will speak on "Where Do Business and Lighting Go From Here?"

Calling System Layout

Call and return-call buzzer and annunciator systems are among the most widely used of all signaling apparatus. This article discusses this application layout and installation.

By A. A. Schuhler

JUNCTION BOX COLOR CODE CHART

| Post No. | Sta. Term | Sta. No. | Color Code | | | Junction Boxes | | | |
|----------|-----------|----------|------------------------|--------------|---------------|-----------------------------|---|---|---|
| | | | Base | First Tracer | Second Tracer | | | | |
| 1 | L 1 | 1 | Black | — | — | J 5 | — | — | — |
| 2 | L 2 | 1 | White | — | — | " | — | — | — |
| 3 | C | 1 | Red | — | — | " | — | — | — |
| 4 | L 1 | 2 | Green | — | — | " | — | — | — |
| 5 | " | 3 | Orange | — | — | " | — | — | — |
| 6 | " | 4 | Blue | — | — | " | — | — | — |
| 7 | " | 5 | White | Black | — | " | — | — | — |
| 8 | " | 6 | Red | " | — | " | — | — | — |
| 9 | " | 7 | Green | " | — | " | — | — | — |
| 10 | " | 8 | Orange | " | — | " | — | — | — |
| 11 | " | 9 | Blue | " | — | J 4 | — | — | — |
| 12 | " | 10 | Black | White | — | " | — | — | — |
| 13 | " | 11 | Red | " | — | " | — | — | — |
| 14 | " | 12 | Green | " | — | " | — | — | — |
| 15 | " | 13 | Blue | " | — | " | — | — | — |
| 16 | " | 14 | Black | Red | — | " | — | — | — |
| 17 | " | 15 | White | " | — | " | — | — | — |
| 18 | " | 16 | Orange | " | — | " | — | — | — |
| 19 | " | 17 | Blue | " | — | J 3 | — | — | — |
| 20 | " | 18 | Red | Green | — | " | — | — | — |
| 21 | " | 19 | Orange | " | — | " | — | — | — |
| 22 | " | 20 | Black | White | Red | " | — | — | — |
| 23 | " | 21 | White | Black | " | " | — | — | — |
| 24 | " | 22 | Red | " | " | " | — | — | — |
| 25 | " | 23 | Green | " | " | " | — | — | — |
| 26 | " | 24 | Orange | " | " | " | — | — | — |
| 27 | " | 25 | Blue | " | " | J 2 | — | — | — |
| 28 | " | 26 | Black | Red | Green | " | — | — | — |
| 29 | " | 27 | White | " | " | " | — | — | — |
| 30 | " | 28 | Red | Black | " | " | — | — | — |
| 31 | " | 29 | Green | " | Orange | " | — | — | — |
| 32 | " | 30 | Orange | " | Green | " | — | — | — |
| 33 | " | 31 | Blue | White | Orange | " | — | — | — |
| 34 | " | 32 | Black | " | " | " | — | — | — |
| 35 | " | 33 | White | Red | " | J 1 | — | — | — |
| 36 | " | 34 | Orange | White | Blue | " | — | — | — |
| 37 | " | 35 | White | Red | " | " | — | — | — |
| 38 | " | 36 | Black | White | Green | " | — | — | — |
| 39 | " | 37 | White | Black | " | " | — | — | — |
| 40 | " | 38 | Red | White | " | " | — | — | — |
| 41 | " | 39 | Green | " | Blue | " | — | — | — |
| 42 | " | 40 | Orange | Red | Green | " | — | — | — |
| 43 | — | — | Red No. 14 B & S Gauge | | | Transformer to Button Board | | | |
| 44 | — | — | White | " | " | " | " | " | " |

THERE are many signaling systems which come within the category of calling systems. However, in this article it is intended that it shall cover the plain call buzzer and annunciator systems, and the return-call buzzer and annunciator systems. These installations are as a rule quite extensive and are generally used to call persons in their individual rooms or office from one central point. Typical applications are nurses homes, dormitories, Y.M.C.A., Y.W.C.A., etc.

A plain call system may be composed of a centrally located plate or block having a pushbutton for each outlying room or office. Each of the outlying stations would consist of a buzzer. To extend this further the central calling station may be provided with a buzzer, while the outlying stations may be equipped with a pushbutton in order to make it a return-call system. This enables the called person to answer the call and indicate that the signal has been received. Still another feature may be provided on the outlying stations to assure receiving calls even though the called person has temporarily left the room or desk. This is a target or drop which remains visual until the return call pushbutton is operated, which action automatically resets this indicator.

Annunciator systems operate in much the same manner. However, in these systems the annunciator is located at one or more points. Plain pushbuttons at outlying stations operate their respective drops in the annunciators. In return-call annunciator systems the annunciators are provided with a pushbutton for each outlying station, and each outlying station is provided with a buzzer and a pushbutton. The target or drop feature may also be incorporated into the outlying stations. If electrical reset type annunciators are used each individual drop may be reset by another individual pushbutton, or a pre-determined group

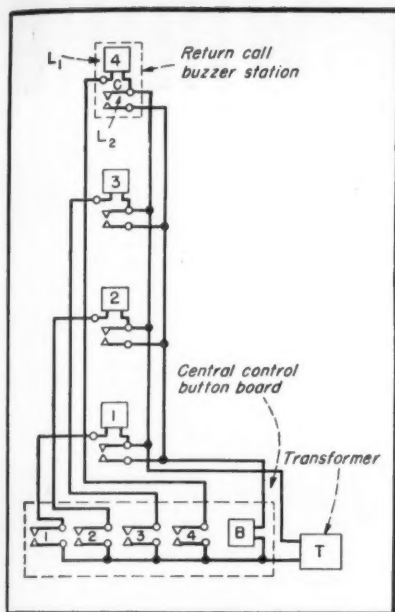


FIG. 1. Wiring diagram of return-call buzzer system.

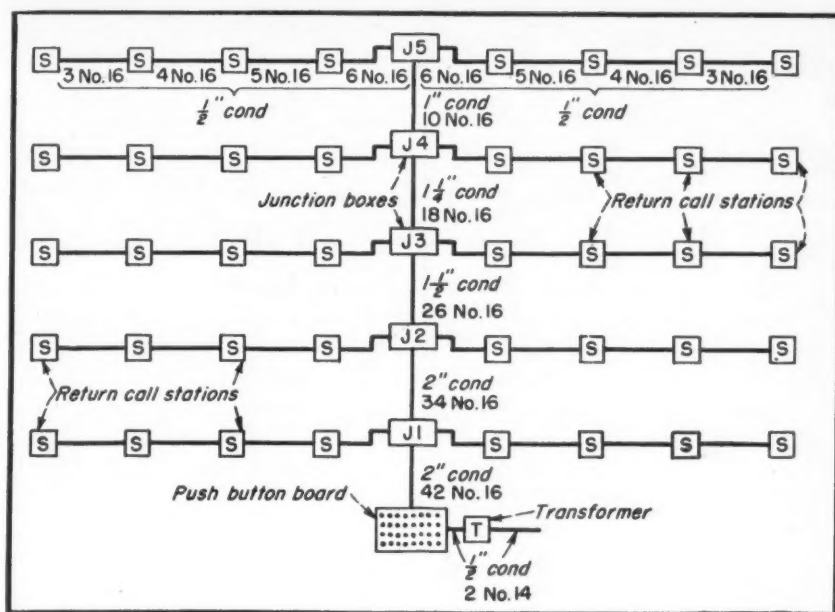


FIG. 2. Riser diagram with layout details of a return-call buzzer system.

of drops may be reset collectively if desired.

Lamp annunciator systems may be operated in much the same manner as drop annunciators. However, as a general rule if they are to operate from remote points from pushbuttons, each lamp is provided with a relay to keep the lamps illuminated until reset. Relays may be enclosed with the annunciators or may be installed in separate cabinets. Lamp annunciators may be operated from remote points by means of toggle switches of the single pole type in which case the lamps would be extinguished by the original station making the call. The use of three-way switches permits the resetting at either the calling or the called station.

In the systems described, all equipment whether installed concealed or exposed permits the conduit or raceways to be run directly into all outlet boxes. However, where pushbutton blocks are used, or where annunciators are located on desks, such equipment is usually equipped with flexible cords and terminal blocks or terminal boxes. Separable connectors may also be provided on these cords or cables for making connections to wiring in underfloor ducts and other raceways.

In laying out an installation, the routine of checking the specifications to determine the type of system, its features, components and construction should be followed. The manufacturers wiring diagram should be thoroughly studied. A plan should then be made showing the location of the equipment such as the outlying stations, the cen-

tral control pushbutton plate, the riser, floor or main junction boxes, power supply and the number of wires required between all points. For rigid conduit installations, the sizes of all conduits should be shown. A separate chart should be made to show the size of each junction or pull box, and the number of terminal strips and connectors. In addition a directory chart should be made to show the color code and the wire connections. Spare conductors and terminals on strips should be considered in every installation.

A typical return-call buzzer system is shown in Fig. 1. The system functions as follows: Only one call can be made at one time since there is only one buzzer at the central control point to receive an answer. The central control board has 40 pushbuttons and one buzzer. The outlying stations consist of one buzzer and one pushbutton. Operation of a pushbutton at the central control board will operate a buzzer at the respective outlying station. Operation of the associated pushbutton in the outlying station will operate the buzzer in the central control board.

A riser diagram of a conduit instal-

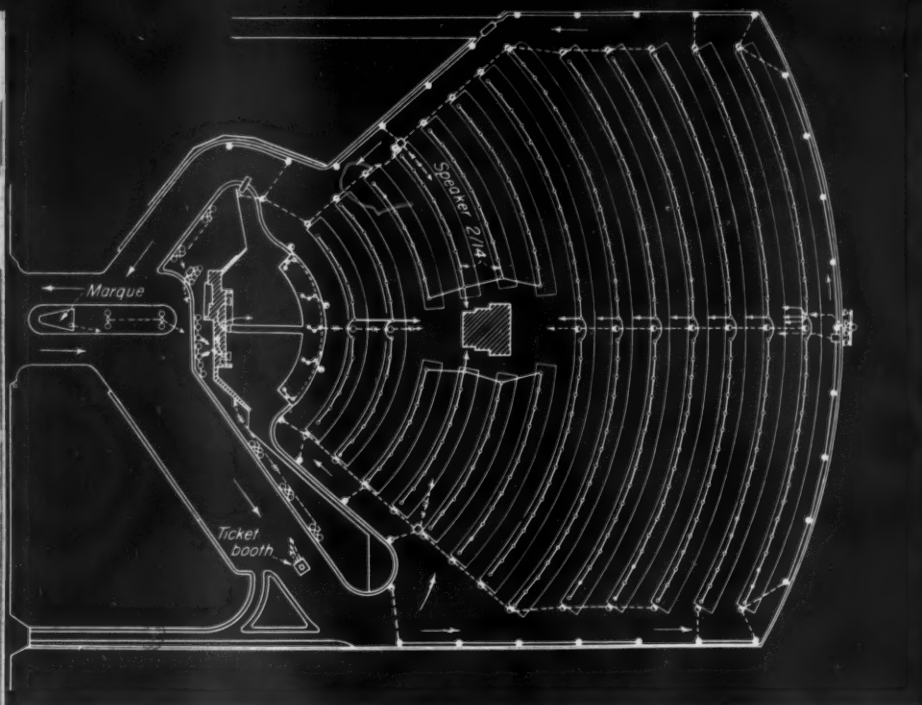
lation is shown in Fig. 2, and indicates the relative location of all return-call stations, the central control pushbutton board, junction or pull boxes, transformer, and the number of wires between all points with the sizes of all conduit runs. The location of the room stations, central pushbutton board and the transformer is shown on the electrical plans. In dormitories, nurses homes, Y.M.C.A., Y.W.C.A. and small hotels the location of the equipment is usually typical throughout the building. The location of the junction and pull boxes is occasionally shown, however, in most cases is determined by the contractor. The transformer should be located at a central point but is frequently near the central control board.

The riser diagram shows a total of five junction or pull boxes, one for each floor where rooms are equipped with return-call stations. Terminal strips should be installed in all of these cabinets or boxes. Standard sizes should be selected as previously suggested for layouts of intercommunicating telephone systems. The terminal strip in junction box J1 having 42 wires should have 21 pairs of terminals (1-21 pair strip), junction box J2 having 34 wires should have 17 pair of terminals (1-7 & 1-11 pair strip), junction box J3 having 26 wires should have 13 pair of terminals (1-16 pair strip), junction box J4 having 18 wires should have nine pairs of terminals (1-11 pair strip), junction box J5 having ten wires should have five pair of terminals (1-7 pair strip),

[Continued on page 131]

JUNCTION BOX DATA

| Box No. | No. Term. | No. Pairs | Size Block | Size Box |
|---------|-----------|-----------|--------------|-----------|
| J 5 | 10 | 7 | 6" x 2" | 6" x 9" |
| J 4 | 18 | 11 | 9" x 2" | 6" x 12" |
| J 3 | 26 | 16 | 13" x 2" | 6" x 16" |
| J 2 | 34 | 18 | 9" x 6" | 12" x 12" |
| J 1 | 42 | 21 | 16 1/2" x 2" | 6" x 20" |



PLOT OF HIGHLAND THEATRE showing the electrical system serving the area.

Drive-in theatre projects present unusual wiring and lighting problems.

By Geo. B. Stone

Manager, Pacific Electrical & Mechanical Co., Inc.
Los Angeles, Calif.

DRIVE-IN theatres, or, in the vernacular of the show people, the "ozoners", represent a field of interesting and specialized wiring for the electrical contractor who will undertake to study the specialized problems involved and put forth the extra effort necessary for the proper execution of his job.

This section of the amusement field has been growing and improving to keep up with the modern trend in the theatre business. Apparently, climate and local factors have little to do with the number of such theatres.

In a general way, an ozoner represents approximately a \$20,000 to \$30,000 job for the electrical contractor, depending on the size of park; snack bar and the type of fixtures used. The building is usually in some outlying community and on ground outside of the limits of the town or suburb where the large amount of land required, bordering on an arterial road, can be obtained more cheaply. The superintendent on this line of work can therefore make up his mind to driving anywhere from 50 to 75 miles a day, much of it in a pick-up carrying this thing

and that. In addition, he will be required to select his crew of electricians and helpers, including foreman, from the community and train them in the requirements of the work.

A number of such installations are now either completed or in course of construction by our organization. Notable among them are half a dozen for the California Drive-in Theatre Co., at El Monte, Lakewood, Van Nuys, Colton, Burbank, and Orange, Calif. There is another that we are doing at the present writing, at San Bernardino. This is the Highland Theatre, owned by the Highland Theatre Co., Harry Deckerman president and owner, the architect being William Balch & Louis L. Bryan of Los Angeles. E. T. Walden is superintendent for the owner.

At one time or another, a large number of the readers of this publication have no doubt visited one of these drive-ins and sat in their cars on the low ramps and viewed the screen without neck strain. However, at such times their thoughts probably did not dwell too much on the size and intricacy of the electrical installation which made the attraction possible. So, tak-

ing this Highland Theatre as the basis, I shall summarize briefly the main characteristics of the theatre layout and the principal features of the electrical system, which extends from the street curb in front to a point behind the last row of "seats".

The marquee is located at the curb line, while the main building is approximately 200 feet back of it. The main building is 75 ft. wide and 68 ft. high and will carry the huge pictorial display easily seen from a mile away. The lights on the building and marquee are neon. A bank of floodlights illuminates the building front and lights the way to the ticket booth at the right. This whole front, therefore, will be of intense brightness to attract trade.

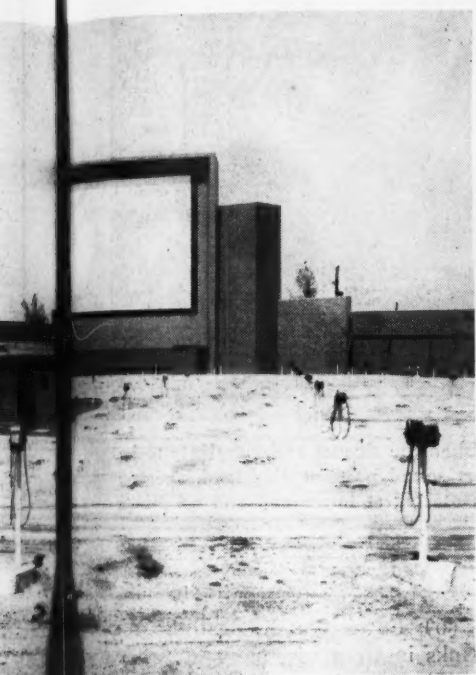
On the back side of the building, where the 42 ft. by 60 ft. screen is erected, all must be in near darkness, with only enough light to enable the cars to maneuver into their places, and such lights as there are must be carefully shielded so that none of the patrons looking toward the screen will see them. Of these structures it may be said in general that in various places we are called upon to use light lavishly,

WIRING



REAR OF THE EL MONTE THEATRE in daytime. In the foreground is the projection and snack bar building. The sound posts are easy to see now,

OZONERS



but at night it is a tricky electrical problem to enable cars to find "seats" without throwing any light toward the screen.

while in the theatre proper we are continually fighting light.

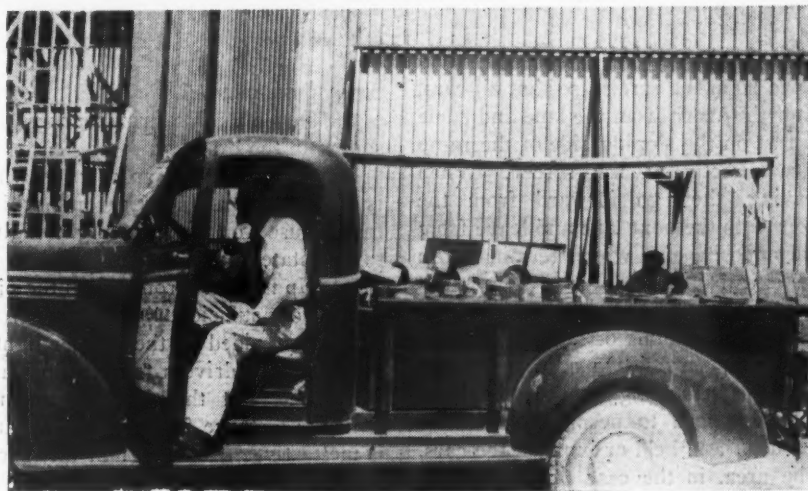
Light from the marquee, building front, and that originating from nearby buildings and signs and from cars in the street is shut off from the screen parking area by the building itself and by two high wing walls extending from the building at an angle on either side, high enough to take care of any light spill-over coming from the front.

Cars form in two lines on the entrance drive and pass by the two-window ticket booth. Their headlights must be turned off and the drivers proceed down the line to the various ramps, which are arranged in semi-circles facing the screen. This procedure is not left to any method of dead reckoning on their part, for they are half blind when they come in. They are assisted by row marker lamps and have the further assistance of ushers.

The ramps are slight convolutions or waves in the grade, 28 feet from crest to crest. The center part between convolutions is level, while a typical section through an average ramp shows the crest to be two feet above the level part. The height diminishes with dis-



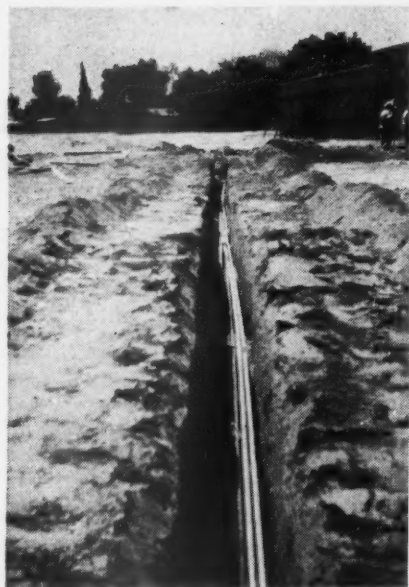
THIS IS WHAT THE THEATRE OWNER must have in front—show information and sign attraction, all in a glare of light.



THE CONTRACTOR'S TRUCK drives up to the Highland Theatre site with a load of cans to protect cable ends during paving.



TYPE OF CONCRETE BLOCK used to support sound posts. Blocks are partially buried in the pavement. Superintendent Cummins indicates approximate grade line.



CONDUIT FOR FEEDERS to ticket booth, Highland Theatre. All conduit for power and light and cable for sound are buried like this in earth below pavement.



THE ELECTRICAL CONTRACTOR furnished the sleeves and couplings to be molded into the concrete blocks to support sound posts at Highland Theatre. They were cut and threaded on the job. Note lug at lower end and couplings or nipple at the upper end.

tance from the screen, so that all cars, after they turn from the lane and come to rest on the sloping side of the ramp face directly at the screen. When leaving, they go forward from the slope into the next lane and leave from the opposite end, which terminates in the exit drive.

The dots along the ramps in Fig. 1 show the locations of the sound posts. One post serves two adjoining cars. The speakers hang on the post, with sufficient cord to permit them to be lifted off and held or hung in the cars. The area, in the case of this theatre provides for 772 parked cars. In addition there is seating capacity for 300 people in a stand up front—pedestrians not entering in cars. The seats are arranged in a circle facing the screen and on a radius of about 80 ft. therefrom. These patrons come in through a separate entrance.

Turning now to the drawing, the lighting scheme for the markers is readily followed. Drivers coming in from the ticket booth, with their headlights turned off are many of them more or less blind. Even with the lane markers visible on the left, many would be as liable as not to run into the fence on the right. Therefore, the fence line is indicated by 25-watt fence lamps at intervals, in reflectors pointing downward, lighting the curb, only, and a foot or two beyond it. The row markers, opaque on the side away from the screen, are 10 watt. There is also a row of 10-watt aisle markers placed

down the center of the aisle. Details of the fence lights and row markers are shown in the drawing.

Back of all the ramp rows is what is called the "artificial moon", which can be used on non-moonlight nights to facilitate the entrance and exit of cars. Up near the front, when the picture is on, sufficient light comes from the screen, aided by the marker lights, to enable the drivers to get into place or leave. But this light diminishes with the distance from the screen and is ineffective after about half way back. Here, the artificial moon takes over and faintly lights that part of the area. It consists of a bank of mercury vapor lamps mounted on a 70-ft. pole, with four 15 amp. single pole circuit breakers in weatherproof panel located three feet above grade line.

In the case of this particular project, we, as electrical contractors were called upon to perform the following:

- (1) Furnish and install all rigid conduit for light and power and two-conductor cable for sound. They are buried in the earth under the paving, laid in trenches dug before paving.
- (2) Completely connect everything, including light, power and sound.
- (3) Furnish and install all switch gear and panels.
- (4) Connect all electrical equipment furnished by others, such as ventilation, refrigeration and appliances.
- (5) Furnish threaded sleeves and couplings for connecting sound posts to bases.

(6) Furnish and install floodlight banks in front of building.

(7) Furnish mercury vapor lamps and install them on the pole for the artificial moon.

In connection with the installation of the sound posts, a rather interesting problem turned up. The concrete bases for these posts were precast by the theatre company. One section through the large end of the block is shown in the drawing. The whole block is shown in one of the photographs. A 2-in. conductor sleeve is cast in the block, with lugs at the lower end and threaded for a coupling at the top, one half of the coupling being embedded in the block and one half projecting above the top. The two inch sound post is screwed into the coupling later, after the block is in place. The cable ends from the trench pass through a groove in the bottom of the block and up through sleeve, coupling and post into the transformer and control box mounted on top of the post.

The installation would have been simple enough had we been able to set the blocks before paving and pull the cable ends up through at that time. But it would have been practically impossible for the paving contractor to place the asphaltic material and roll it properly in and around through the forest of posts. Therefore, the paving had to be done first, covering the whole surface, and later the post points had all to be relocated and excavations made

[Continued on page 161]

FURTHER progress has been made on the reorganization of code-making machinery by the new streamlined Correlating Committee which was formed after the dissolving of the Electrical Committee of NFPA last year.

The National Fire Protection Association, sponsors of the National Electrical Code, has issued the following revised "National Electrical Code Procedure", the result of the work of the Correlating Committee to date.

Electrical Section, NFPA

The NFPA as sponsor of the Code, has organized an Electrical Section. One function of the Section is to provide opportunity for presentation and discussion, in open meeting of proposals for revisions of the Code. In addition, proposals may be filed by members of the Section or by the public with the Secretary of the Section and its Correlating Committee.

Regulations of NFPA

The activities and program of the Electrical Section are subject to the Regulations for Sections of the Association.

Membership of the Section

Membership in the Electrical Section is open to any associate member of the Association and to designated representatives of an organization member.

Meetings of the Section

The Section will meet annually at the time and place of the National Fire Protection Association's annual meeting (unless omitted on the request of the Section with the consent of the NFPA's Annual Meeting Program Committee). Other meetings of the Section may be held at times and places it may select.

National Electrical Code Committee

The Electrical Section reports its recommendations to the Association concerning revisions of the National Electrical Code which have been proposed by the National Electrical Code Committee of the Section.

The functions of the Committee are:

- A. Interpreting provisions of a current edition of the National Electrical Code, including Supplements.
- B. Handling proposals for Tentative Interim Amendments of a current edition of the National Electrical Code, including Supplements.

NEW CODE PROCEDURE

New channels for interpretation, amendments and revisions are outlined for reorganized code-making committees and panels.

C. Developing, periodically, revised editions of the National Electrical Code, including Supplements.

The National Electrical Code Committee consists of:

1. A correlating Committee, and
2. A number of Code-making Panels.

Correlating Committee

Membership

The membership of the Correlating Committee shall be appointed by the Board of Directors of the National Fire Protection Association. The Board also appoints the Chairman of the National Electrical Code Committee and of the Correlating Committee and a non-voting Secretary of both Committees.

Functions

The Correlating Committee has the following functions:

1. Determines the policies and steps incident to revising the National Electrical Code.
2. Organizes the Code-Making Panels.
3. Reviews all reports by Code-Making Panels that recommend changes or additions to the National Electrical Code and Supplements; approves them, or directs they be referred back for further study.
4. Determines upon the Approved Procedure for interpreting the National Electrical Code, or Supplements.
5. Determines the general procedure with regard to proposals for Tentative Interim Amendments of the Code or Supplements; and reviews recommendations of Code-Making Panels with respect to Tentative Interim Amendments, and, if acceptable, approves them in the name of the National Electrical Code Committee.
6. Reports to the Electrical Section and to a general meeting of the NFPA, the sponsor, its approval of a proposed new Edition, or of a Supplement, of the National Electrical Code, recommending final approval as a Standard.

Meetings

Meetings of the Correlating Committee shall be held at the call of the Chairman. Seven members shall constitute a quorum. Action by the Committee approving changes in the National Electrical Code shall be on the basis of at least seven affirmative votes; provided that if any absent member registers disapproval the action must be reaffirmed by letter ballot or at a later meeting of the Committee.

Revision of the National Electrical Code

To be approved and recommended by the Correlating Committee a revision of the National Electrical Code shall be:

- A. A Tentative Interim Amendment,
- B. A Supplementary Revision, or
- C. A General Revision.

A. Tentative Interim Amendments—A Tentative Interim Amendment is a revision applied for and processed in accordance with the Approved Procedure for Tentative Interim Amendments.

Note: This Procedure as now approved by the Correlating Committee is, in principle, that previously in effect, in accordance with which several tentative amendments were announced by the former Electrical Committee.

B. Supplementary Revisions—A Supplementary Revision of the National Electrical Code will ordinarily appear at yearly intervals as the result of reports from one or more Code-Making Panels that recommend amendments of Articles of the Code or propose new Articles. Supplementary Revisions will be identified according to the year of their publication. Their respective contents may have further consideration when a General Revision is undertaken.

C. General Revisions—A General Revision of the National Electrical Code will be planned as follows:

(Continued on page 188)

[illegible]

CORE OF PAPER PROCEDURES is quadruplicate form containing all information pertaining to the job. Winding data is filed on separate data card.

IT was one of Hitler's H. E. bombs in 1940 that landed us into the motor repair business. One night a direct hit demolished our workshops and next day I sought and secured bigger and better premises. In those days there was a big demand for getting electric motors repaired and rewound, and as we now had plenty of space I decided to equip part of our new premises for this work.

8000 square feet of floor space was laid out for repairs and rewinds, and we constructed right down the centre of our ground floor shop a long steel bench consisting of Morrison Indoor shelters. These are the correct height for benches and ideal for heavy motors. During the war they served a dual purpose, our employees could duck under these when bombs fell or when "Doodle-bugs" passed overhead. At that time nearly all our work was for factories and various branches of the fighting services, including the American Army and 8th Air Force.

When the war finished and our ex-service men returned we set to work to tackle peacetime problems and to organize our motor repair work so as to be able to give our customers reli-



EVERY MACHINE is thoroughly examined on the day it is received, and a report is sent to customers as to what repairs are necessary.

METHODS FROM A LONDON SHOP

How a British motor repair firm organizes shop procedures and paper work.

By William E. Steward

William Steward & Company, Ltd.
London

able and prompt service. We found that most of our new customers came to us because other repairers had not given them satisfaction, and we therefore took the trouble to find out what had made them dissatisfied.

We found that the main reasons were (1) Delivery promises not kept. (2) Work not carried out thoroughly. Although costs are always important this is not always a major factor, and customers will very often willingly pay more for repairs if they are carried out speedily and thoroughly.

Although it is impossible to apply mass production methods to this type of work where practically every job is different and where numerous problems arise every day, we decided to get down to a systematic method and to break down the work into separate and definite stages. This enables men

to specialize on the particular branches of the work they are most capable of doing, and to use skilled labor to the best advantage, and it also enables us to keep a close check on the progress of each job and to insure that nothing is overlooked.

Our whole system is based on a printed form which we call "Form S.1" A set of four forms is issued for each motor. No. 1 for Customer. No. 2 for Workshop. No. 3 for Accounts Dept. and No. 4 for Progress Office. On these forms are typed full name-plate details of machine, accessories received with machine, Customer's observations. Our report on examination, details and price of spares required, and an estimate of the cost of the work.

The customer's copy is posted to him the same day as machine is received,



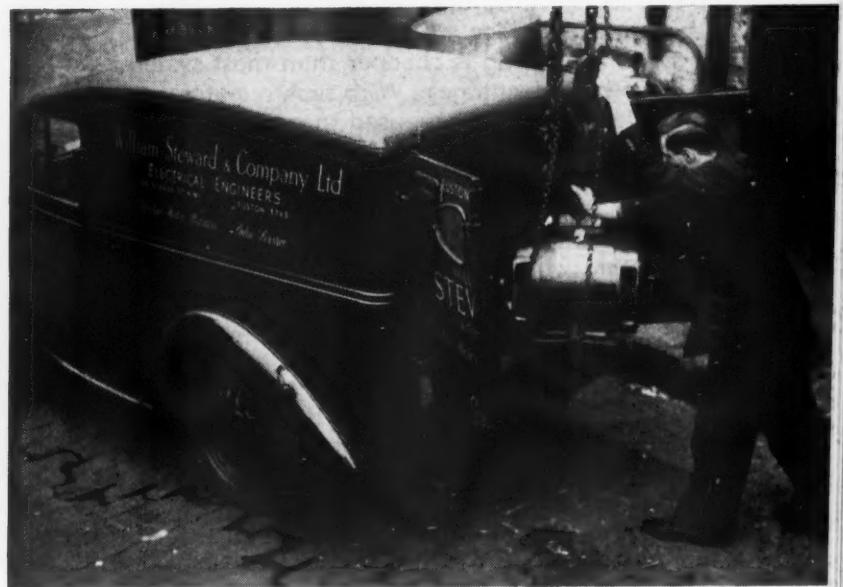
TAKING DATA of windings of an armature before stripping.



SKIMMING SLIPRINGS on a 20 hp. rotor. Slotting machine for cutting keyways in pulleys is seen on right.



THE WORKS OFFICE keeps up-to-date records of every machine under repair.



URGENT REPAIR JOBS are delivered and reinstalled by our Service Engineers.

or at latest the following day, this entails a very prompt examination of all incoming machines, but it assures the customer that his motor is being dealt with promptly and also advises him when he can expect it back and how much it will cost. There are exceptional cases when we cannot give a definite delivery date or estimate of cost, but in 80 percent of our jobs we are able to do so.

The Accounts copy goes to Accounts Dept. and on this they have a copy of our estimate and report. The back of the Accounts Copy is arranged as a Costs Sheet and enables a detailed record of costs to be entered as work proceeds.

The Progress Copy goes in Progress File and on this is entered every day the stage reached in the work. The Works Manager consults these fre-

quently and is able to give reliable information to customers.

The most important copy is the Workshop copy. This is printed on thicker paper, it accompanies the machine during all stages of the work, and workmen write their reports in the spaces provided for each department. It gives every workman the history of the work being done, and when the job is complete is filed for record.

When a machine is received for repair it goes first to Reception Bay. Here full details are taken, including accessories and the machine is given a Job Number and labelled with this number. These labels are issued for each machine so that main parts can be labelled when dismantled. Red labels are issued for very urgent jobs. It is then immediately sent to Exami-

nation Bench. This bench is equipped with test plugs for various voltages both a-c and d-c, insulation tester, starting resistances, flash tester, meters etc. We use a Mains operated insulation tester which is fixed on the panel, it is less likely to become damaged than a portable instrument and can be easily operated by one man.

On the examination bench the motor is dismantled so far as is necessary to find out what is wrong with machine, and what repairs and spares are necessary to put it in first class condition. These details are entered on Section B of the Form. The Form is then handed to storekeeper who enters price of spares, and these are allocated to the job. The remaining copies of the Form are then typed and the Customer's copy is dispatched.

[Continued on page 160]

ELECTRICAL SERVICE in the

A report on recommended types of power installations throughout the general hospital prepared as a guide to architects and electrical contractors by the Federal Security Agency, U. S. Public Health Service*

SERVICE

(a) **Main Power:** The electrical service brought into the building may be primary or secondary depending upon the load demands and other local conditions. The service conductors should be brought into the buildings underground where possible, to improve landscaping and reduce the possibility of interruption of service. A 3-phase, 4-wire, 120/208 volt system of wiring is cheaper than most systems and has other advantages. With such a system, any distribution panel may be used to supply either or both the 3-phase or single-phase current.

(b) **Emergency Power:** Where available two services from independent generating plants, or two services from separate transmission lines of a network system where each transmission line may be isolated by automatic switches and the other line fed from another source of the network system should be used, one for normal use and the other for breakdown or emergency service. Should the capacity of one source be limited, it can be used for the minimum required emergency lighting only. Where a second outside service is not available, a storage battery or a generator of the same voltage as the main lighting voltage should be used for the emergency lighting. In large hospitals, an internal combustion engine driven generator or a steam driven generator is preferable to a large storage battery because of the difference in space and maintenance requirements. A light-duty storage battery may be used in addition to the generator to eliminate light flicker while the generator is starting. An automatic gasoline engine driven generator is preferable to a manually operated steam driven generator.

In small hospitals, storage batteries are generally preferable for the source of emergency power. In any event the emergency service should be connected by means of an automatic transfer switch which will connect the emergency source of power to the hospital emergency circuits in case of interruption of main power supply, and will automatically reverse the connection back to the main feeder when its energy is restored. The transfer switch should be of a type which will not permit both sources of power to be connected at the same time. (c) **Telephone service:** Telephone cables should be brought into the building underground, where practicable, for the same reasons as underground power cables.

* Noyce L. Griffin, Electrical Engineer
Office of Technical Services U. S. Public Health Service

PANELBOARDS AND SWITCHBOARDS

All panelboards and switchboards should be of the dead front type, enclosed in metal cabinet, with hinged door and latch, and with schedule, under glass or other suitable transparent material, of all circuits connected and spares, or diagram of circuits. Where locked cabinets are provided all locks should be keyed alike.

SWITCHES

(a) Automatic circuit breakers for power and light feeders, and for lighting and receptacle branch circuits are more expensive than fused switches for the initial installation, but are preferable.

(b) Local or wall switches of the mercury or equal silent type are recommended on all patient floors to reduce noise. If silent switches are not used, the night light switch should be located in the corridor. Night light switches should be mounted 5-6" from the floor, or about 1'-0" above other wall switches. Wall mounted switches should be used where practicable, in preference to pull-switches, to reduce maintenance. Where lights are installed in small closets, automatic door switches are recommended. Switches located in areas where combustible anesthetics are used or stored should be mounted in explosion-proof enclosures.

WIRE

All feeders and circuits should be installed with high grade wire as required or permitted by the National Electrical Code for the various services. High temperature wire is required at hoods, ranges, boilers, etc. Lead sheath or waterproof wire should be used underground and where condensation may form, as in refrigerator boxes, roof slabs, and connections to outside lights. The code should be consulted for special conditions. The life of the wire and the dependability of the electrical system are determined by the conductor insulation. There is little difference in cost of wire with the minimum required insulation and that of a better grade.

CONDUIT

All hospital wiring should be in conduit to facilitate alterations and repairs. Wiring for the nurses call system should be in conduit of ample size to permit future alterations of the system with the minimum amount of labor and alterations to building. Explosion-proof wiring must be in rigid conduit. Underground wiring should be in non-metallic conduit. Spare conduits or conduit sleeves through walls or floors, where future service is likely is advisable.

GENERAL HOSPITAL

LIGHTING

(a) Lighting in all areas of the hospital should be designed for comfortable seeing.

Work spaces should be relatively free from shadows and with sufficient illumination on work areas to eliminate, so far as practicable, the need for portable units with extension cords on floor or work area. Discomfort from lighting is generally caused by direct glare from fixture or reflected brightness from ceilings and walls. In public and office spaces the tendency is toward fluorescent lighting as it gives better diffusion and requires less wattage per footcandle. The first cost of fluorescent lighting is about double that of filament lighting; however, on an annual basis over a period of ten years where the first cost, maintenance and power cost are included, the total cost of fluorescent lighting per footcandle per hour is generally less than that of filament lighting.

(b) The lighting of offices, corridors, public spaces, shops, boilers, and machine rooms, kitchens and storage spaces can be treated as similar spaces in other types of buildings. The design of fixtures is not fixed by any special requirements for these areas, so the architect is free to choose or design any fixture which lends itself to the architectural scheme; however, fixtures should be of a type which can be easily cleaned and easily relamped.

(c) Patients rooms and wards should have general illumination and a night light controlled by switches at the door. Each patient should be provided with a bed light with convenient control switch at the bed. A bracket light over the lavatory, dresser lights, floor lamp with semi-direct reflector, ceiling lights, and combinations of the above have been used for general illumination.

Ceiling lights used for general illumination in patients rooms or wards are not generally recommended, but where used they should be designed so that direct rays from the light source are not visible to the patient. The brightness of the fixture and spots on ceilings and walls should not appear in too great contrast with the surrounding areas. Floor lamps are generally preferable to ceiling fixtures, but their cord connections are objectionable. Night lights included as a part of the general illumination units have been used, but separate night light units of the flush type, wall mounted, are generally preferred. Where a separate night light unit is provided, it should be mounted about 18" above the floor and at a point which will not be covered by furniture and where it will normally not be seen by the patients. Floor lamps and adjustable lamp fixtures attached to the bed have been used for bed lights with varying degrees of success; however, they may shine in patients' eyes and are subject to breakage. Floor lamps occupy usable floor space and interfere with free movement of attendants around the bed. Adjustable fixtures

The current billion dollar federal-aid civilian hospital program will build more than 500 hospitals within a few years, most in non-urban areas. These standards have been written to guide the electrical work. Much of it is "spelled out" with reasons for the recommendations given because a good portion of the work will be done in areas where there is little or no experience with modern hospital electrification practice and with "specification grade" wiring. Because of the vital role electrical facilities play in modern hospitals, we are publishing the recommended electrical specifications in full.—Editor

attached to the bed usually require considerable maintenance and interfere with free movement of the bed. Wall mounted bracket fixtures present a problem of correct lighting for the patient when the head section of the bed is elevated to different positions. New wall mounted bracket lights are being developed which may overcome these deficiencies.

(d) Operating and delivery rooms should have general illumination for the rooms and special lights for the tables, separately controlled. The operating and delivery tables should be lighted with multiple beam from different angles, focused at the table to penetrate a deep cavity and to prevent shadows.

These lights may be of the unit type with internal or external reflectors mounted to permit lateral and angular adjustment, or they may be flush ceiling lights with directive lenses. These lights should have two or more filaments or bulbs as a precaution against lamp failure. The general illumination should be of such intensity that there will not be too great a variation of brightness for the surgeon when he raises his eyes from the operating field.

(e) In laboratory and autopsy rooms, where critical observations of specimen color is required, the light source should provide a color effect as near as possible to that in which such tests or observations are ordinarily viewed. Lighting color may be identified by reference to coordinates on a color chart developed by the International Commission on Illumination (ICI), or more commonly by temperatures in degrees K of a black body radiator which correspond to the colors on the ICI color chart. Daylight and filament lamp lighting have in the past been the most common sources of illumination. Filament lamps cover a rather wide band of the visible spectrum while fluorescent lamps, individually, accentuate some colors. Due to the color difference, fluorescent lamps are usually catalogued as to color temperature in degrees K. Practically any hue within the entire lighting color range can be ob-

tained with staple lamps or a combination of them. (g) Solaria with specially lighted wall murals of pleasing outdoor scenery are expected to gain favorable consideration in the future to correlate the trend of treatment methods of getting patients out of bed and walking about in a shorter time than has been the practice in the past.

(h) Emergency lighting should be provided for operating and delivery rooms, exits, stairs, and some corridor lights.

(i) Exit, stair and corridor lighting should conform to local or State codes, or if such codes do not exist, or are not in effect, the "Building Exits Code."

(j) Illuminated signs may be required in areas where there is much visitor traffic, such as information desk, cashier's office, and out-patient department. Where such lighting is likely to be required, plug-in receptacles should be conveniently located.

(k) Good lighting is important and conducive to efficiency. Listed in the following table are the current recommended lighting intensities for the various hospital areas:

HOSPITAL ILLUMINATION

| Space to be Lighted | Current Recommended—Foot-candles | Space to be Lighted | Current Recommended—Foot-candles |
|-------------------------|----------------------------------|------------------------|----------------------------------|
| Corridor—8 Ft. | 5 | Fluoroscopy | 10 |
| Emergency Room | | Dark room | 10 |
| General | 50 | Waiting room | 10 |
| Local | 200 | Office & viewing | 30 |
| Examining Room | 50 | Pharmacy: | |
| Kitchen: | | General | 30 |
| Central | 20 | Work table | 50 |
| Floor, Kitchen & Pantry | 20 | Private Rooms & Wards: | |
| Laboratories: | | General | 5 |
| Close Work | 100 | Reading | 30 |
| General, room | 30 | Scrub-up rooms | 20 |
| Work tables | 50 | Sewing room: | |
| Laundry: | | General | 20 |
| General | 15 | Work Area | 50 |
| Presses & Ironers | 20 | Solaria | 30 |
| Sorting | 20 | Stairways | 5 |
| Libraries | 30 | Sterilizing, central | 30 |
| Lobby | 20 | Storage, central: | |
| Morgue & Autopsy: | | General areas | 10 |
| Autopsy Room | 30 | Office | 30 |
| Autopsy Table | 200 | Surgery: | |
| Morgue, General | 20 | Clean-up | 30 |
| Nurses Station: | | Operating Room | 50 |
| General | 20 | Operating Table | 1000 |
| Desk & Charts | 30 | Therapy: | |
| Nurseries: | | Physical | 15 |
| General | 20 | Occupational | 30 |
| Examination & Treatment | 50 | Toilets | 10 |
| Obstetrical: | | Treatment Room: | |
| Clean-up room | 30 | General | 30 |
| Delivery room | 50 | Examining Table | 50 |
| Delivery table | 200 | Utility Room | 30 |
| Offices: | | Waiting Room: | |
| General | 30 | General | 10 |
| Med. Records Room | 30 | Reading | 30 |
| X-Ray: | | Wards: | |
| Radiography & | | General | 5 |
| | | Reading | 30 |

RECEPTACLES (Convenience Outlets)

(a) Receptacle outlets should be provided in all places where plug-in service is likely to be required, to reduce the need for alterations and extensions of service after the hospital is completed. Duplex or other suitable outlets should be provided as required in office and work spaces for machines, fans, clocks, lamps and appliances. In the patient's bed room there should be, in addition to the bed light, a duplex convenience outlet at the bed for radio, examination light, heating pads, blankets, etc.

(b) Some hospitals use a central radio receiving system wired with three channels to each bed, so that the patient may choose one of three broadcasts or recordings. For such reception, special aerials and wiring are required. Aerial outlets at beds are required for portable radios in areas and buildings where reception is poor, but in general the aerial built into the set serves satisfactorily.

(c) In the corridors and spaces accessible to visitors and out-patients, receptacles may be required for lighted signs.

(d) Special convenience outlets in corridors spaced about 40 feet apart are very desirable for use of portable x-ray and cleaning machines. They should be of the 3-pole type, rated at 20 or 30 ampere, as required, with one pole grounded.

(e) Heavy duty receptacles should also be provided in pantries and utility rooms for hot plates, portable sterilizers, etc. Should electrically heated food carts be used, they will also require heavy duty receptacles.

(f) Shops, boiler room, and storage areas may require receptacles for extension lights and portable tools.

(g) Nurses station may require a receptacle for a desk light.

(h) Receptacles in operating and delivery rooms should be of the 3-pole explosion-proof type with one pole grounded. Receptacles in any other "Class I Group C" hazardous location (where combustible anesthetics are used or stored) should be of the explosion-proof type.

HAZARDOUS LOCATIONS

(a) A hazardous location in a hospital is a space in which fires or explosions are likely to occur which may result from many causes, including arcs from electrical equipment or sparks from electrostatic charges in the presence of explosive mixtures of combustible anesthetic gases.

(b) The use of approved explosion-proof electrical equipment will prevent explosions which might be caused by arcs at the electrical equipment. All electrical equipment in a hazardous location should be of explosion-proof construction, including switches, receptacles, film viewing cabinets, etc. Lighting fixtures 7'-0" or more above the floor in rooms properly ventilated are not required to be explosion-proof. Film viewing cabinets of the flush or semi-flush type should be installed in each operating room. These viewing cabinets should be ex-

plosion-proof, or sealed gas-tight on the operating room side and with access for changing lamps from the corridor, or outside the hazardous area.

(c) Special consideration must be given to the prevention of explosions due to sparks from electrostatic charges which may be generated in the room.

Sparks from electrostatic charges can be prevented by effectively grounding all equipment and persons in the room, so that the static charges may be neutralized or conducted off to ground harmlessly as they are generated. In the case of persons walking in the room and portable equipment in the room, the most effective and convenient method of economically grounding all persons and equipment is to provide a grounded conducting floor and provide a conducting path to the floor from all persons and equipment. All personnel in the hazardous location should wear shoes with conducting rubber or other suitable conducting material, and should not be permitted to wear outer clothing made of materials known to be highly static producing, such as wool, silk, and rayon. All portable equipment should be of metal or otherwise made conducting, including all of the integral parts except parts of electrical equipment required to be insulators. All table leg tips, casters, etc., should be of conducting rubber or other suitable conducting material. High relative humidity (55% or more) will assist in providing a conducting path to ground by virtue of a very thin film of moisture on the surface of materials which usually dissolve enough impurities to make the film slightly conductive. The flooring should be of conductive material having a continuous conductive surface of such character that a foot, table leg, or equipment placed on the floor in any normal position will be in contact with the floor grounding circuit, for the purpose of dissipating electrostatic charges.

CALL SYSTEMS

(a) Electrical call and signal systems should be provided in all hospitals so that patients may receive prompt service and that the nurses, doctors and attendants may operate more efficiently. The most important of these systems are: Nurses' call, doctors' paging, and doctors' in-and-out register.

(b) **The nurses' call system** consists of a call station for each patient, from which the patient can call the nurse. Each call station should be connected to operate a signal light in the corridor above the patient's door, and a signal light and buzzer or an annunciator at the nurses' station, and in the floor pantries and utility rooms of the nursing unit. Except where an annunciator is used, two or more signal lights at the nurses' station are often desirable to indicate the section of the floor from which the call was made. For private rooms and where private nurses are employed, an annunciator should be used at the nurses' station instead of the signal lights. For private room service, an annunciator should also be used in the nurses' rest room on the floor. Supervisory recorders or annunciators for

the superintendent of nurses have been used but are not recommended.

(c) The call stations are of two general types, the push-button and the pull switch. The push-button station consists of a push-button on a cord for initiating calls and a recessed release button whereby the call is normally turned "off" by the nurse who answers the call. The push-button and release assembly for bed patients are of the portable type, completely insulated, pear or oblong shaped, attached to one end of the multi-conductor extension cord. On the other end of the extension cord is a special plug for attachment to the wall mounted call station. These plugs may be obtained for either one or two extension cord connections. The call station is so constructed that should the plug be accidentally detached, a call will register continuously until the plug is replaced or turned off manually at the call station. Where there are more than two call stations in a room, each should have a pilot to indicate from which station the call was initiated. Push-button and release assemblies of the flush type for wall mounting are available, and are desirable for patient bath and toilets, and for nurses' use in nurseries. Explosion-proof nurses' call stations are available for use in operating and delivery rooms.

A less expensive call station is that of the pull-switch type which consists of a tumbler switch flush mounted on the wall above the bed and operated to the "on" position by one pull-cord for one patient, or by either one of two pull-cords for two patients. The switch is reset to the "off" position by the nurse who answers the call. The pull-switch stations are not as desirable as push-button stations for general use but are often preferred in contagious areas as the pull cords are inexpensive and may be replaced with new cords for each new patient. One objection to this type of station is that the noise of the switch, when operated, may disturb patients in the same room or an adjoining room. This objection may be eliminated by use of a mercury switch. The main advantage of this type of station is that it is cheaper and can be connected to the 110 volt lighting system and utilize neon-glow signal lamps.

(d) A more expensive system for nurses' calls which is being given favorable consideration is the intercommunicating type with a microphone and loud speaker at the bed. The patient can signal for the nurse or speak to her and receive an answer. By leaving the patient's microphone open, the nurse may check on a patient without leaving her desk by listening to breathing and other sounds. In addition to the higher first cost, maintenance and replacement are more expensive than for the simple system, but it can save many nurses' steps.

(e) The doctors' paging system may consist of loud speakers located throughout the hospital, chimes on which doctors' numbers may be sounded, or the flasher type which indicates the doctors' numbers. The loud speaker and other audible calls in the nursing units are objectionable as they may disturb

patients and attendants. The flasher system consists of a keyboard and flasher at the telephone switchboard, which has the advantage of being silent. The telephone operator may set the board to flash as many as three doctors' numbers automatically in rotation. The numbers appear on annunciators located in all sections of the corridors. The same number of numerals—usually three—should be used for each doctor, so a burned out lamp may be located. These paging systems can also be used for calling internes, administrators, heads of departments, and their assistants, and engineers. These flashers may also be used for other general calls such as "fire" with red F and buzzer.

(f) The flasher call system has its shortcomings as the individual may fail to see his numbers when flashed. For this reason the flasher system is sometimes supplemented with loud speakers at points where internes, department heads, and doctors may congregate, as in the doctors' lounge, staff dining room, laboratory, engineer office, etc., where the calls will not disturb the patients.

(g) The radio call promises to overcome all these objections. This system consists of a low powered sending station from which calls are broadcast throughout the hospital to miniature receiving sets which the doctors and others may carry in their pockets. This system has been developed, but has not yet been placed on the market.

(h) **The doctors' in-and-out register** serves a useful purpose as it permits the doctors to register "in" and "out" with minimum effort and delay. The system consists of a board at the doctors' entrance on which all staff doctors are listed, and has a toggle switch at each name. Each doctor on entering turns on his switch, which indicates on an annunciator at the telephone switchboard that the doctor is "in". When leaving, the doctor registers "out" by turning off his switch. The doctors' "in" and "out" switches may be located at more than one entrance by using three-way or four-way switches, as required. These boards may be provided with a signal light at each doctor's name to show when he is "in" and the same light may be connected with a switch and flasher at the switchboard to indicate to the doctor as he enters or leaves that he is wanted.

(i) **Call-back systems** are used for nurses' and internes' bedrooms. With such systems the nurses and internes can be awakened, called for duty, or called to the telephone by push-buttons in the office which operate buzzers in the rooms. The room called can answer by pushing a button which registers on an annunciator in the office. The main office pushes may be connected so several rooms or sections may be called by one button.

TELEPHONES

Interconnecting telephones should be provided for all department heads, assistants, operating and delivery suites, nurses' stations, offices, housekeeper, doctors' rooms, record rooms, diet kitchens, etc. These may be connected on a dial system which

will permit interior communication without calling the hospital switchboard. At all private and semi-private beds, telephone jacks should be installed so a telephone can be plugged in at any time with a minimum rental charge to the hospital. Rigid conduit should be provided for all wiring to all instruments. An empty conduit should be left for instruments which might be required at a future date. This arrangement has proved to be most efficient and entirely satisfactory. Public pay stations should be provided at convenient points for visitors and hospital personnel.

INTERCOMMUNICATION

(a) Telautograph systems which transmit written messages from one department to another are being used successfully by some large hospitals. These systems have the advantage that they leave a written record of the message at the receiving station. The electrical wiring is installed by the hospital and the instruments are furnished to the hospital on a rental basis. The first cost and rental charges are relatively high, which accounts for the limited use of these systems.

(b) Audible speaker systems with microphones and loud speakers are being used with success for communication between Superintendent and department heads.

(c) Pneumatic tube systems are useful to carry records, prescriptions, and orders from one department to another. These systems are operated by a vacuum or a vacuum-pressure combination in tubes to move the carriers from one position to another. The installation and operation expense of this type of powered carrier system is seldom justified for a small hospital. For small hospitals a relatively inexpensive system is often used for transmitting non-powered carriers vertically, such as: Message drops consisting of tubes through which carriers are dropped to floor below by gravity, and message lifts consisting of a counterweighted carrier for gravity drop and a multiple cord pull for lifting the carrier which is held in position by two guide wires.

FIRE ALARMS

Where there are no State or local fire alarm codes the "Building Exits Code" should apply. Where fire alarm systems are required, devices used in the system should be listed by Underwriters Laboratories, Inc., or Factory Mutual Laboratories or certified to comply with the requirements of such listed devices. In all cases the system should be electrically supervised, preferable of the code signal type. The electrical supervision provides that a break or any condition in the circuit which would interfere with the operation of the equipment causes the actuation of a suitable trouble signal. This trouble signal should be audible and located where it may be heard at any time by responsible personnel. Some codes require that alarm gongs be located in patient corridors, but many hospitals object to these locations as they tend to cause panic

and false alarms disturb the patients unnecessarily. Where such locations are designated by code, a pre-signal system may often be used to notify all nurses, superintendent, engineer, elevator operator, and telephone operator and all offices when the alarm is turned in. Then, should the fire be serious, the second or general alarm can be sounded. Where not required, the general alarm feature is omitted and all nurses and hospital personnel receive the first alarm. A silent alarm can then be flashed to all sections of the hospital with the doctors' call system by using an annunciator with a red "F" and buzzer.

CLOCKS

Electrical clock systems should be provided, with clocks at nurses' stations, main lobby, telephone switchboard, kitchen, laundry, dining room, and boiler room, as well as in the operating and delivery rooms. The clocks should be of the recessed type, preferably with a narrow frame. In the operating and delivery rooms, an additional clock with separate minute and second hands which can be started, stopped and reset, is desirable.

X-RAY

(a) An independent feeder should be installed for X-ray equipment. The capacity of the feeder should be such that the voltage drop will not exceed 3%, and preferably 2½%, of the rated feeder voltage. A separate transformer for the X-ray feeder is often required.

(b) As a protection against X-ray radiation, lead or equivalent barriers are required to limit the radiation dose to a safe value for operator and persons in adjoining areas. The maximum permissible dose of 0.1 roentgen per day has been the standard published in the applicable codes. It is reported that the maximum permissible dose has been reduced to 0.3 roentgen per week as established by the National Committee on Radiation Protection. Dark room should be protected against radiation to prevent clouding of undeveloped films.

SPECIAL INSTALLATIONS

(a) Short wave, ultraviolet ray, or sterile-ray lamps have been used in some hospitals to reduce the bacteria count in certain areas. They have been used in the ceilings of operating and delivery rooms, and around the operating room light. They have been used in nurseries, and to form a curtain of ultraviolet rays of high intensity to prevent the passage of bacteria from one area to another. These lamps have also been used in ventilating systems, particularly where air is recirculated, and in virus and bacteriological laboratories as a protection for technicians. To be effective, the intensity of the rays must be maintained at about their normal rating, by keeping lamps and reflectors clean. Bactericidal lamps of the ultra-violet type used in the presence of ether are reported by the National Bureau of Standards as possibly contributing to some of the explosions in operating rooms, due to its accelerat-

ing action in forming diethyl peroxide, from ether, which is extremely explosive even at low temperatures. For this reason and until further information is available, the installation of bactericidal lamps in operating and delivery rooms and in other locations where ether is used or stored is highly questionable. It should be noted that ultraviolet-ray lamps for general use in hospitals is still in the experimental stage.

(b) Sun lamps, particularly of the carbon-arc type have been used in some solariums of children's and tuberculosis hospitals. The mercury arc sun lamp produces light deficient in red which makes the human complexion look ghastly and may result in a depressing effect unless supplemented by other light such as that from ordinary filament lamps.

(c) Special wiring must be provided for the X-ray, electro-therapy, diathermy, electro-cardiography, and electronic fever equipment, sterilizers and heated food carts. The wiring requirements should be obtained from the manufacturer, as they are not the same for all makes. The heating, ventilating, plumbing, refrigeration and kitchen engineers must also be consulted to determine the wiring required by them for motors, automatic controls, dampers, sterilizers, kitchen equipment, and other apparatus.

PERMANENT RECORDS

Plans and diagrams on cloth should be furnished to the hospital to indicate the locations and size of all feeders and circuits. The diagrams should show the wiring of all call and low potential systems, in addition to the feeders. Wiring diagrams of special equipment and controls should also be furnished. Such plans and diagrams are of special value at a later time if repairs, alterations or extensions should be needed. Catalogues and operating instructions for all equipment and controls should be assembled and bound as a guide for operation and repair.

TESTS AND INSPECTIONS

(a) After all wiring, switchboards, fixtures and equipment are in place, they should be carefully tested together and separately to determine the following:

- (1) Conductor insulation resistance is not less than that recommended by the National Electrical Code,
- (2) The system is free from short-circuits and other faults,
- (3) Motors rotate correctly,
- (4) All equipment operates correctly and as specified.

(b) Continual testing and inspection of all electrical installations is essential. Even a brief lighting failure may cause annoyance and apprehension, and interfere with proper care. Needless to say, failures of operating room lights or equipment, therapeutic equipment, or other installations may have extremely serious consequences, and no effort should be spared to prevent them.

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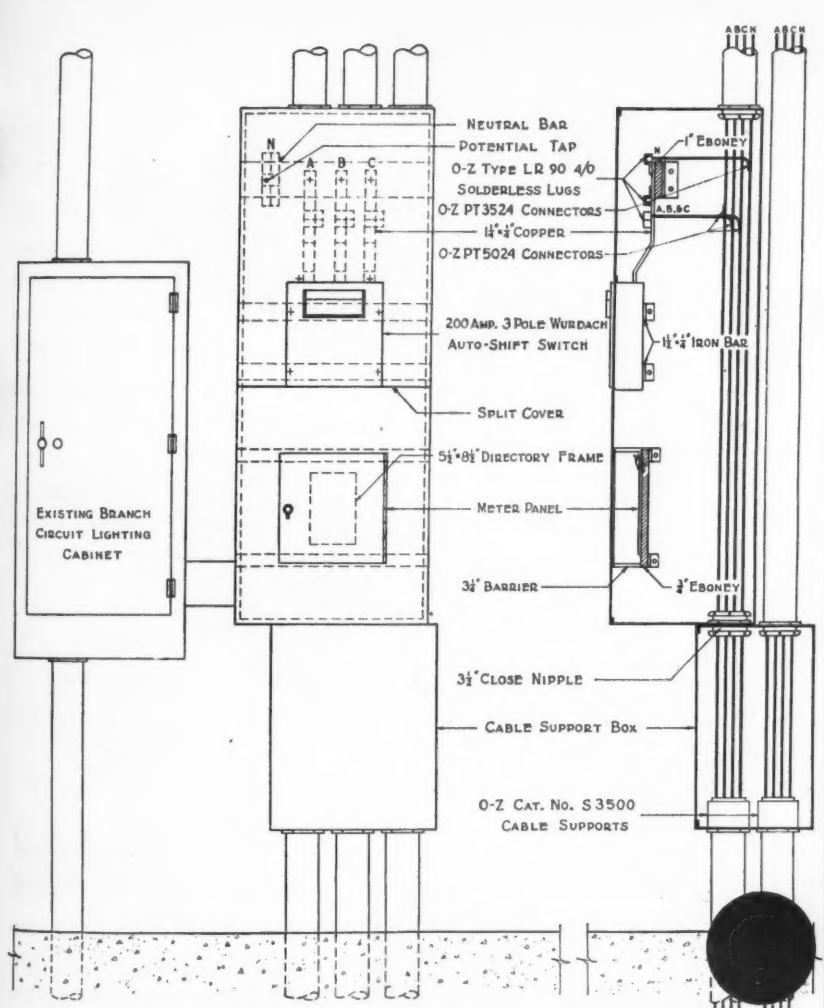
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Practical Methods



Equalizer panel, in parallel conduit risers, connects lighting distribution panel to each of three feeders serving a group of floors. Load fluctuations are equally shared by all feeders in group.

Equalizer Panels Divide Feeder Loads

ENGINEERING

In office building electrical systems, the diversity between loads of different tenants on a floor and the resulting greater diversity between the floors served by one feeder and circuit breaker, permits the installation of relatively smaller feeders and circuit breakers. Engineers are extremely careful in the development of diversity factors for these have a very important bearing on the basic distribution design and economics of the entire electrical system.

The ratio of the sum of the maximum demands of the component parts of a load to the maximum demand of the load measured at the point of supply is the diversity factor. Determination of what diversity may be applied depends upon the flexibility of the feeder system. A system of parallel feeders serving a large area, such as three or four floors of an office building, will provide greater flexibility than single risers serving a smaller area of one or two floors.

This fact was given careful consideration by Ralph H. Decker, Chicago consulting electrical engineer, when he designed the electrical distribution system for a Chicago Loop office building that was being changed over from direct current to alternating current service. He chose the parallel feeder approach to flexibility and diversity. In general, three parallel riser conduits serve four floors; two risers serve three floors.

Every floor served by a group of feeders is tapped on to each feeder in that group. For example: Three $3\frac{1}{2}$ inch conduits, each containing three 500 MCM phase cables and one 350 MCM neutral cable, serve the sixth, seventh, eighth and ninth floors. The existing lighting distribution panel on each of these floors is fed by all three parallel feeders. This is accomplished by the installation of an "equalizer" panel between the feeders and the distribution panel on each floor. Its function is to provide a common terminal for the three parallel feeder taps and a single disconnect for the branch circuit panel.

The panel, shown in the accompanying diagram, consists of long phase and neutral bars for feeder tap terminals, a disconnect switch and meter panel, all combined in a single enclosure installed in the parallel riser column. The term "equalizer" describes its prime function. It equalizes the load on all three feeders serving the floor. In the same manner, load fluctuations between floors served by this group of risers are divided or equalized on all three feeders. Should the load on the 8th and 9th floors be heavy, and that on the 6th and 7th floors be unusually light, each feeder would carry one-third the combined load of all four floors.

If the single feeder system were used (one feeder serving one or two floors), under similar circumstances one feeder would be operating at capacity and the other very light. With the equalizer panels, all feeders in the group carry equal shares of the total load—whatever that load may be—at all times.

Since the installation, meter tests have been made, proving the attainment of the initial objective.

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Now you can run approved, permanent surface wiring faster . . . and save time and money on wiring jobs.

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splicing, no taping, no soldering. Result: lower wiring costs, higher profits.

Made of plastic, Monowatt Surface Wiring Units are light, tough and durable. Moisture or other corrosive elements in the air (in barns, for example) will not affect them. Widely used in Quonset huts during the war, these units worked in the dank "impossible" climate of the jungle, and in the 50° below "weather" of the frozen North. Here, then, is no make-shift "temporary" wiring device, but an improved and *job-proved* method of permanent wiring!

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- 2630-1 Single Pole Switch
- 2633-1 Three Way Switch
- 2650-1 Pull Chain Lampholder
- 2655-1 Keyless Lampholder
- 2670-1 Junction Box or Rosette
- 2690-6 BX Cable Clamp

Save wiring time, cut installation costs—boost your profits on wiring jobs!

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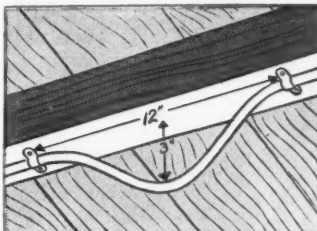
ON THE FARM. Farm buildings are being electrified more than ever before. You can get a bigger share of these new farm wiring jobs if you use lower-cost, faster-to-install Monowatt surface wiring units. Low cost and long-lasting, they're just the thing for farm wiring.

IN THE CITY. Take advantage of the growing need for approved, low-cost wiring. Use Monowatt surface wiring units for wiring garages, basements, attics, utility spaces . . . anywhere you now wire with conventional surface wiring you can cut costs by switching to Monowatt.

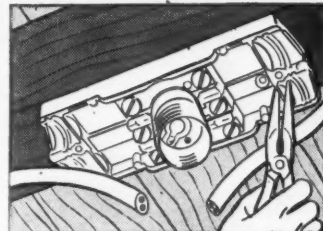
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These surface wiring units typify the line of Monowatt construction devices. With Monowatt materials you wire faster, and at lower cost. Ask your Graybar salesman to show you the complete, money-making Monowatt line. You'll be interested in the many cost saving features.

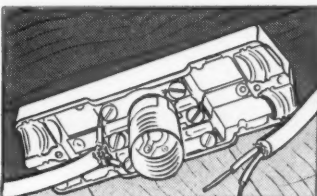
SAVE WORK HOURS



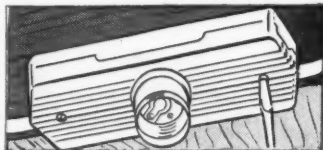
1. Run cable, leaving a loop for each device you plan to install.



2. Cut each loop. Screw down device. Break out knockouts for cable.

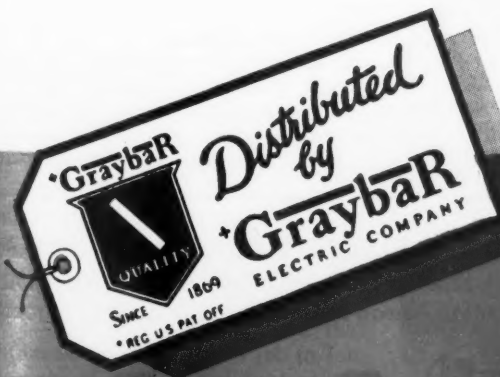


3. Strip and attach wires. No splicing necessary.



4. Screw down cover. Non-metallic cable (or building wire) is clamped firmly in place without need for special connectors. Ask your Graybar salesman to demonstrate to you this exclusive Monowatt feature.

For BX, separate metal clamp secures cable and acts as continuing ground.



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Shut out shutdowns with "plug-in" power

DOES high cost of power shutdowns keep you from making desirable layout changes in your plant?

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With "Plug-In" BUStrIBUTION Duct, you can change machinery layout without shutdowns. To move a machine, simply unplug it from the duct . . . move . . . and re-plug in the nearest "plug-in" outlet.

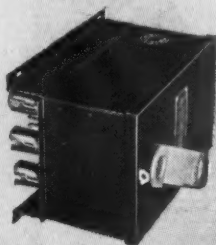
All other machinery on the line keeps producing during the move. No production stoppage is necessary, since there is no power outage. "Plug-In" Duct furnishes *live* power to all other machinery.

If plans necessitate a complete change in plant layout, the "Plug-In" Duct is 100% salvable. Because it is prefabricated, an entire system can be dismantled and set up to the new requirements, without scrapping a single part!

Ask your local Bulldog Field Engineer about "Plug-In" BUStrIBUTION. He will be glad to answer your questions. Let him show you an installation nearby.

Bulldog Field Engineers welcome the opportunity to sit in with you during the early planning stages of a building project. Their knowledge of electrical distribution layout can mean savings in installation costs, as well as efficiency and reliability in actual operation. Why not take advantage of this service?

One type of bus plug, showing "fingers" which grip bus bars in "Plug-In" Duct. Many types of Bulldog bus plugs are available to answer your specific needs. Capacity: 30 Amps. to 600 Amps., 600 Volts or less, 2, 3, and 4 Poles.



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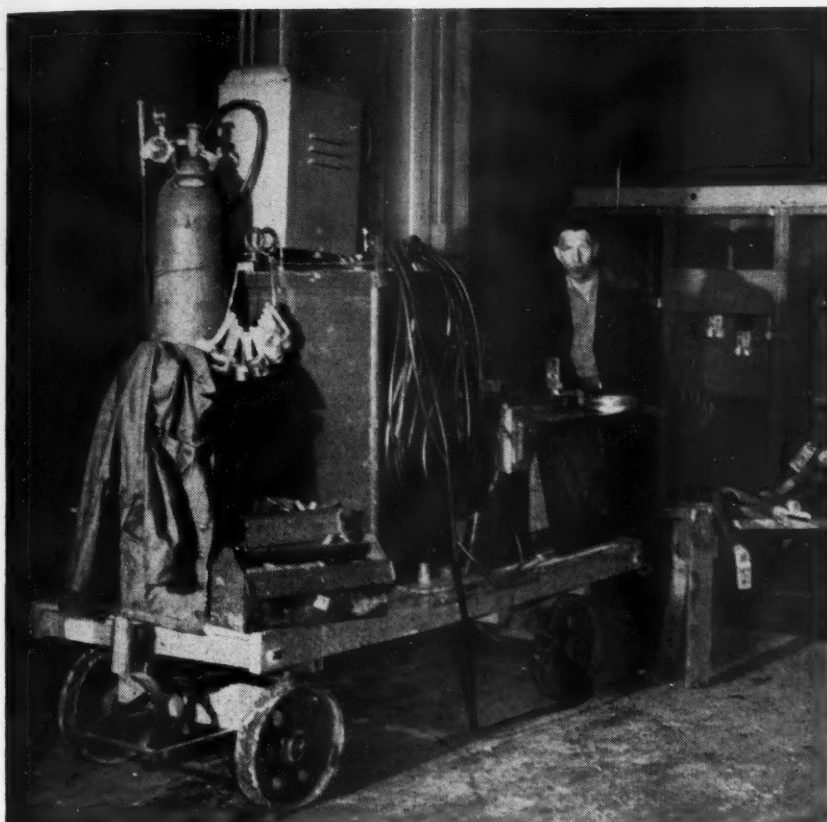
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HEADQUARTERS FOR ELECTRICAL DISTRIBUTION



Portable welding unit for making argon-shielded arc weld terminal lug connections to aluminum cables at a control cubicle location in the Davenport ALCOA plant. Unit includes water storage tank and circulating pump for cooling electrode holder; also workbench and cable vise.

Portable Argon-Shielded Arc Welder

—WIRING

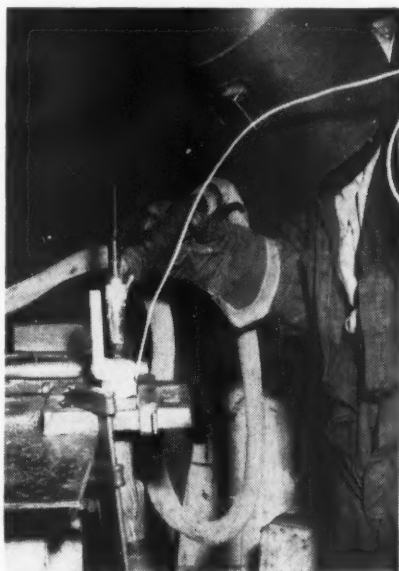
Inert-gas-shielded arc welding is one of the newest techniques recently encountered by electrical contractors working with aluminum cables and lugs. This process, used for making terminal connections on large aluminum cables, requires no flux; uses a tungsten electrode; a 2S or 43S aluminum welding wire; and an envelope of inert argon gas (coming from the tip of the electrode holder) that presents oxidation of the metal during the welding process.

All cable terminals above 350MCM in size were made in this manner at the new Alcoa plant in Davenport, Iowa. Compression lugs were used on smaller cables. Thousands of aluminum lugs were welded to cables at switchboard and control board locations throughout the huge rolling mill—an activity that led to the development of a portable welding unit that could be easily moved from job to job.

Because of the intense heat at the tungsten electrode, the electrode holder must be water-cooled. This meant that electricians making the cable terminals always had to have access to

a water tap and drain—a requirement that is practically impossible on a new construction project where all welding could not be done at a single location.

Fischbach and Moore engineers solved this field problem by mounting the argon-shielded arc welder on a



Heavy metal vise grips cable in vertical position for weld, helps dissipate heat. Neoprene jacket is stripped back over cable for several inches to prevent burning during weld.

portable truck. A 15-gallon water tank with electric pump was added to provide the circulating water coolant for the electrode holder. Anti-freeze was added for winter operation. Thus, only an electrical connection was needed in the vicinity of the job.

Built in as an integral part of the portable welding unit is a workbench with a heavy steel top and a thick metal vise-type clamp that holds the cable ends in a vertical position and helps dissipate heat while the lug is being welded on. To keep the insulation from burning, the Neoprene jacket was slit and stripped back over the cable for a distance of 6 to 8 inches. After the weld was complete, this portion of the jacket was replaced, securely bound with twine and painted with Glyptal.

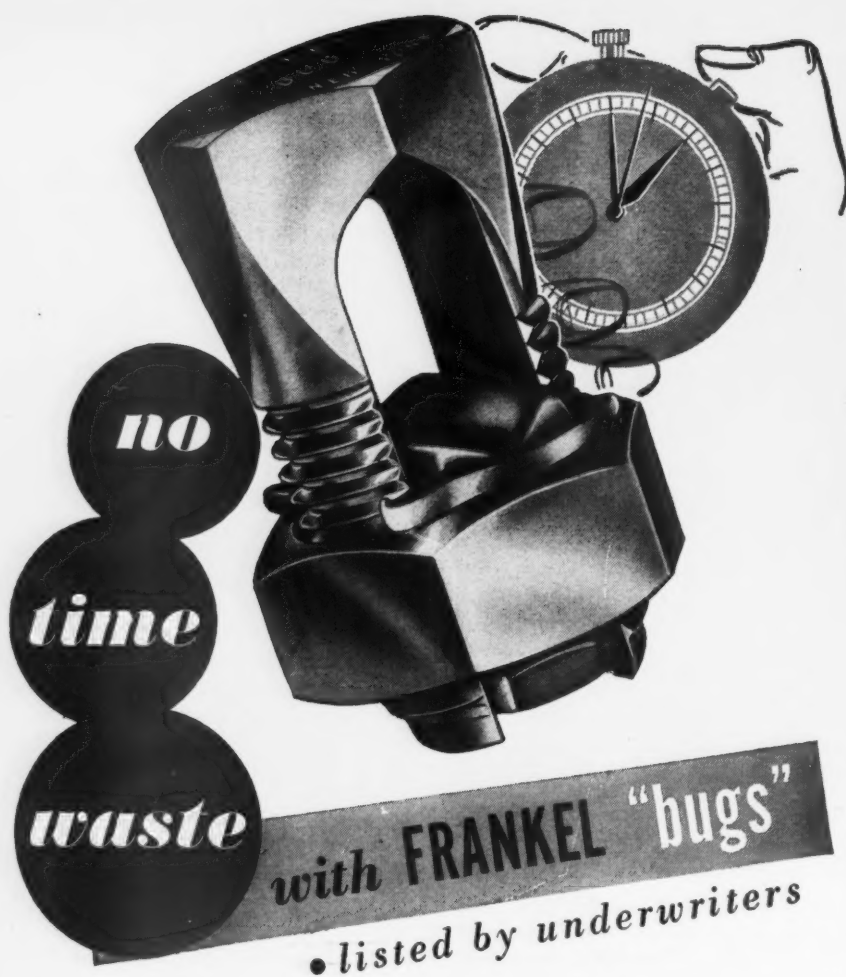
Before each weld was made, both the cable end and lug were cleaned with a carbon tetrachloride solution. The lug was slipped on the cable in such a manner that a $\frac{1}{4}$ -inch deep pocket was left between cable end and top of lug collar. After the argon-shielded arc was first applied to the lug and cable end, the aluminum welding wire was added to fill up the cup and provide a completely fused cable-to-lug connection. Under normal conditions, it took one electrician about ten minutes per lug to make these terminals.

Installing Outlet Boxes In Walls

—WIRING

On new construction involving poured concrete floors, where conduit must be put in place before the floor is poured, the electrical contractor always faces the problem of how to install outlet boxes so that they will be in the proper location in the walls which do not yet exist. One common solution is to bend the conduit, which is to be embedded in the floor, so that a short end will project up out of the floor after it is poured, at a point where the wall is to be located, and then to nipple out to the wall outlet box after the wall is built.

However, for wall outlets which are to be installed in the wall close to the floor, as in the case of boxes for convenience receptacles in an apartment building or residence, another solution which works out well and offers several advantages is that used by the Marshall Electric Corporation, New York City. This solution consists of bending the conduit so that a proper length end piece extends up out of the floor to locate the outlet box in the wall at the position speci-



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Frankel Split Bolt Connectors are easy to use on all types of connections, whether temporary or permanent. A proven favorite for taps, dead ends, motor leads, and in junction boxes, etc. For working in close quarters or mean spots, you can't find a better connector than a Frankel "Bug."

• *compare these advantages!*

1. Extra length pressure bar extending beyond nut, keeps threads firmly meshed, prevents stripping.
2. Extra wide wrench grip on body.
3. No sharp edges to nick wires.
4. All material guaranteed against season cracking.
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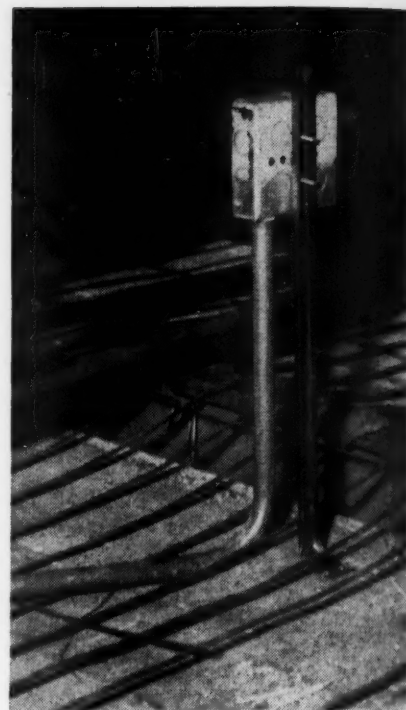
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42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS



Use of steel U-channel facilities location of outlet boxes for convenience receptacles which are to be located in walls to be built after floors are poured, in typical concrete floor construction. Photo shows outlet box in place on U-channel in apartment building as installed by Marshall Electric Corp., New York City electrical contractors.

fied. The outlet box is fastened in place on this short upright conduit end with the locknut and bushing, and the opening in the conduit plugged to keep out plaster and dirt. The outlet box is then bolted to an up-right steel U-channel, which holds the outlet box and conduit in place when the floor is poured. The U-channel has a 90-degree bend and flattened end which is attached to the concrete form, and also has a number of holes on the other end to permit the outlet box to be attached at the proper height to take care of variations in installation dimensions and place the outlet box at the specified height above the finished floor. When the floor is finally poured, both the conduit and the up-right channel will be firmly embedded in the concrete, and the wall can be installed around the outlet box, already in its exact specified location.

Lean-To Houses Secondary Switchgear

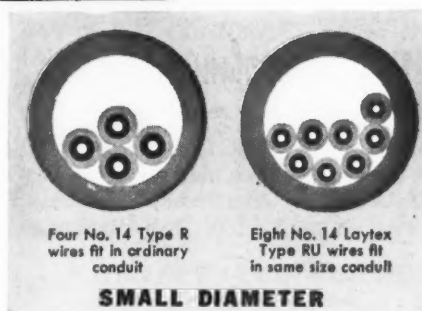
WIRING

Secondary power for the huge rolling mill of the Aluminum Company of America at Davenport, Iowa, is supplied by some 14 substations on a 13.2-



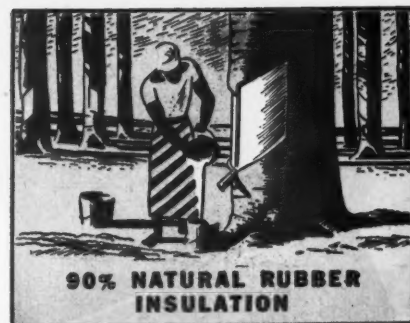
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Mr. USRUBBY, the Wire Engineer, knows what he's talking about. Electricians find that Laytex RU, with its special new wax finish, is surpassed by no other wire in ease of pulling and handling. To be exact, only 22 to 26 pounds pull was needed to pull Laytex RU through the test conduit shown at right—as compared with 32, 40, 42, 45 and 80 pounds, respectively, for 5 other leading brands. In other words, Laytex RU is 33% to 300% easier to pull!



Moreover, Laytex RU permits more wire per conduit on rewiring jobs because it is America's smallest diameter

All wiring with **RU?**



rubber covered branch circuit wire. United States Rubber Company's unique dip method applies 90% pure rubber to the conductors, eliminating the usual bulkiness and weight.



This special method also keeps the conductors perfectly centered in the insulation, preventing thin spots. But that isn't all. The physical and electrical properties of U. S. Laytex RU far exceed those of other building wires! In tensile strength, dielectric strength, insulation resistance, and elongation, LAYTEX RU is unsurpassed. The saturated cotton fibrous cover is flame-retardant and moisture-resistant. There is no finer building wire on the market.

U. S. Laytex RU carries the label of the Underwriters' Laboratories and is listed in the National Electrical Code as an all-purpose wire. Send today for a sample plus booklet containing more details about this wire. Write Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

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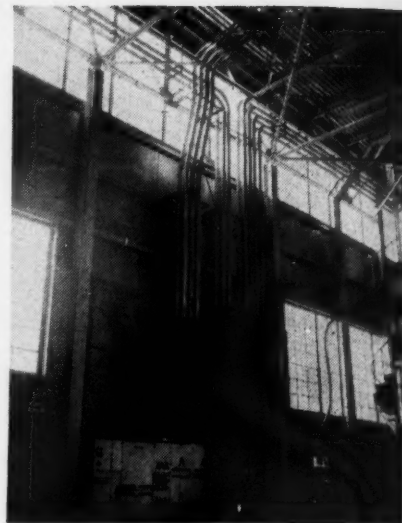


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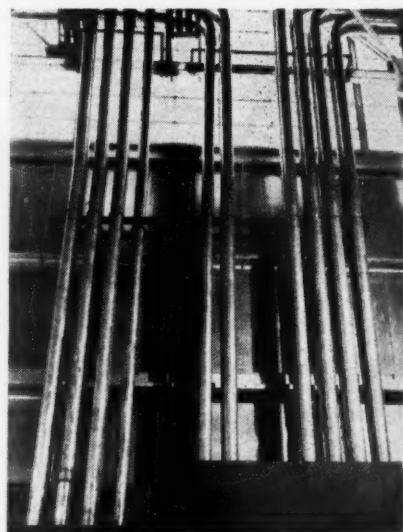


THE EDWIN F. GUTH COMPANY, ST. LOUIS 3, MISSOURI

Leaders in Lighting Since 1902



Secondary switchgear in offset structure keeps mill room area clear for production operations at ALCOA's new Davenport plant.

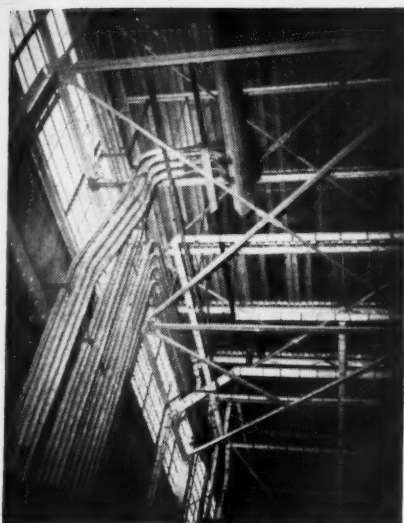


Closeup of conduit risers (aluminum) showing application of wall bracket and-bolt supports.

kv. overhead loop service that practically rings the plant. Most of the transformers are in outdoor substation structures but feed indoor type secondary switchgear.

For a plant of this type where large aluminum sheets are formed and fabricated, clear floor and overhead space is essential to efficient production. Hence, secondary substation cubicles are housed in offset structures immediately behind the outdoor transformer. These three-sided buildings open onto the mill room through a wide arch that provides easy access to the cubicles.

Secondary conduits emerge from the top of the cubicles, then terminate in huge pull boxes on the mill room side of the building wall. Aluminum conduit risers carry these feeders from the pull boxes up to the roof trusses where they extend to other load centers or feed the numerous runs of

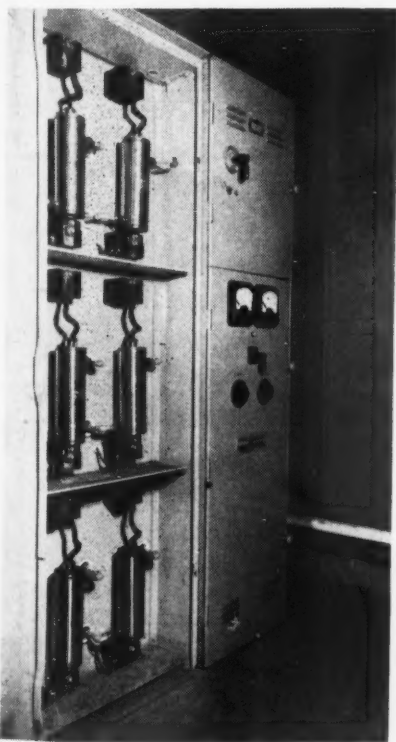


Mass of secondary feeder conduits extending to other load centers and feeding a 3,500-ampere sector bus lateral in trusses.

3,500-ampere sector bus (aluminum) that carry the heavy currents throughout the large building.

Conduit risers are aligned and supported by angle-iron wall brackets equipped with numerous mounting slots for U-bolt anchoring.

Installation, in accordance with design specifications of Alcoa engineers, was made by Fischbach and Moore, Inc., electrical contractors on the project.



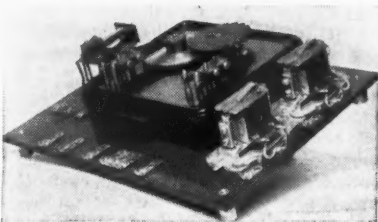
Direct current for crane operation in the new Sandusky, Ohio plant of the New Departure Division, General Motors Corp., is provided by this 100 kw. Ignitron rectifier. Unit requires less maintenance than rotary type.

ELECTRICAL SPECIALTY ITEMS FROM CANNON ELECTRIC



Fire Alarm Station

FIRE ALARM BOX—Combination Open and Closed Circuits. Install the Cannon "Break Glass" Fire Alarm Station and prevent false alarms caused by unintentional leaning or pushing against centrally located suspended hammer-type alarms. Type FA-105C fits any standard single gang outlet box; also available with sub-base adapter for surface mounting. Best suited to smaller fire alarm installations.

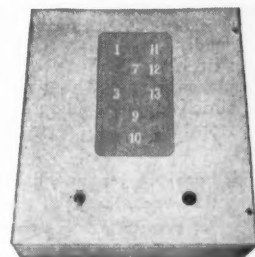


Code Signal Relay

FIRE ALARM RELAY—Motor-Driven Type. Type FA-102M California Uniform Code consists of a code ringer which sounds the signal, and includes a common base, motor and contact making device. Motor operates at 24V or 115V A. C. continuously as long as control circuit is energized. Sturdy in construction and ample power to insure uniform spacing and duration of signal.

Lamp Annunciators

for all types of silent visual signaling in factories, institutions and offices. Made in combinations from four up to a hundred or more lamps. Each annunciator is equipped with intermittent soft tone buzzer, thermostatically controlled. Steel cabinet construction with various finishes available. Lamp change simplified with hinged door design. Identified as the HNA series.



Conduit Fittings Prices Reduced

Effective January 5th, 1949

CNT-1U BOX CONNECTOR (shown above) is listed as approved by Underwriters' Laboratories. $\frac{3}{8}$ " reversible type for BX and Romex flexible metallic conduit. Aluminum Alloy; zinc clamp. Completely assembled with slot head screws. Standard package, 1000 pieces; carton, 100 pieces.

CF-1U- $\frac{1}{2}$ and **CF-2U- $\frac{3}{4}$** are listed as approved by Underwriters' Laboratories. For $\frac{1}{2}$ " and $\frac{3}{4}$ " flexible metallic conduit. Aluminum alloy. Inspected, assembled and packaged. Standard package 1000. All Cannon Conduit Fittings F. O. B. destination on quantities of 100 lbs. or more. Less than 100 lbs. F. O. B. Los Angeles.

★ Write for FA-1 Alarm and Relay Bulletin; CF-7 for Conduit Fittings, and H-2 for Annunciators. Address Department B-231.

SINCE 1915

CANNON ELECTRIC

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3209 HUMBOLDT ST., LOS ANGELES 31, CALIF.

World Export: Frazar & Hansen, San Francisco. Canadian plant: Cannon Electric Co., Ltd., Toronto

New G-E Wiring System Offers Unlimited Possibilities In Modern Lighting Control

Multiple Switching from Many Locations Available at Low Installation Cost With G-E Remote Control

Switch your garage lights ON or OFF from any room in your home—in hospitals, give every patient a light switch next to his bed—in industrial plants and commercial buildings, let every night watchman have a centralized bank of switches for all lights in his area. These are just a few of the many possibilities that can be brought about by the new remote control system, recently announced by the General Electric Company.

Easy to Install

Using existing methods for wiring all power circuits, the General Electric remote control system requires no new materials or techniques except in the switching circuit itself. In this circuit a small, low-voltage relay does the actual switching. Control of this relay can be placed practically anywhere in a building, simply by installing lightweight wires from the relay to conveniently located

wall switches, specially developed for this purpose. "Easy as wiring a doorbell," is the way one observer described this circuit.

Because this new system cuts the cost of materials used in multi-switch applications, because it makes possible a large number of controls on any individual circuit, General Electric remote control clears the way for wide use of multi-switch control in structures of all types.

Keeps Costs Down

In residential wiring, this new system means real "dream-home" electrical control even in residences where costs must be cut to the bone. Simple applications include the example of garage lights given above—also attic fan and cellar light controls in various parts of the house. In the completely modern house, all lights and outlets can be controlled from various locations.

Here are the essential components of the new General Electric remote control system: the switch, the small transformer (not shown), the relay, and the lightweight No. 18 wire. All accessories necessary for the system are manufactured by General Electric and sold through your General Electric Construction Materials distributor.

In dormitories, institutions, and commercial buildings, General Electric remote control can provide an effective centralized system for lighting control. Whenever "lights-out" regulations are in effect, a master panel of remote control switches can be used to enforce these regulations for an entire building or a whole floor. In commercial structures or plants, a similar system can be used to turn out lights left on after hours. Commercial and industrial operations can profit by the over-all multi-switch control offered by this system.

Offers New Ideas

To everyone concerned with building and remodeling, this new system offers a completely new range of ideas on flexibility in the use of electricity. To the architect, it means a new era in electrical convenience in structures of all sizes and types. To the buyer and the investor, it means increased workability and extra value, now and in the years to come. To the electrical contractor, General Electric remote control offers a vast, new field for his services.

To answer questions on the applications of General Electric remote control—to explain the procedure and the materials required—the General Electric Company has prepared an informative booklet on the subject. This booklet is a valuable guide for everyone interested in this new system. To get your copy early, simply fill out the coupon and mail it today.



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GENERAL  **ELECTRIC**

Equipment News



Duplex Limit Switch

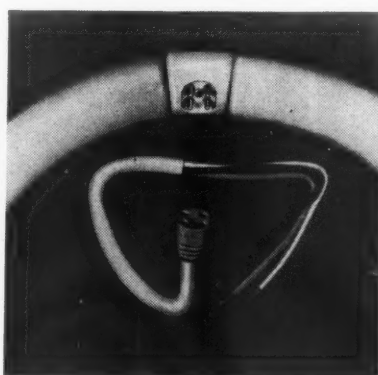
Two new duplex limit switches have been announced that will enable machine designers to use only one switching unit when two limit switches are needed. A single duplex switch can also be used to replace two separate limit switches on present machines or equipment. By using two oiltight switches in a single duplex assembly, only one run of conduit is required for necessary control wires. Both surface and flush mounting types are available. Each switch has a single pole, double throw snap action mechanism and two electrical circuits. One circuit is normally open and the other normally closed. Switches are available with either two push rods, two plain roller arms or two one way rollers. Switches are rated to 600 volts a-c or d-c, and will operate in temperatures up to 200°F. Square D Company, 4041 N. Richards Street, Milwaukee 12, Wis.

Spot Lamp

A new 75 watt R-30 spot lamp, 3½ inches in diameter, and a new flood lamp of the same size, designed to meet the demand for smaller, lower wattage lamps than were previously available, have been announced. Because of their small size they permit the design of smaller individual holders and housing than those required for the R-40 lamps. They are recommended for spot and floodlighting in stores, offices and public buildings, theaters, restaurants, homes, industries, and offices and public buildings, theaters, burning hours. General Electric Lamp Department, Nela Park, Cleveland 12.

Selenium Rectifier

A new line of selenium rectifiers covering the range from two volts and 150 milliamperes to 5,000 volts and 10,000 amperes. Individual plate sizes range from 1¼ in. by 1¼ in. to 6¼ by 7¼ inches. Plates are assembled in an interlocking arrangement between the plate and insulating sleeving so as to prevent possible plate rotation or lug misalignment. Individual selenium plates are capable of withstanding 24 volts rms maximum in the reverse direction and can be overloaded up to 10 times rated load for periods of 7 seconds or less. Efficiency varies from 65 to 85 percent depending upon the circuit employed. International Rectifier Corp., 6809 S. Victoria Ave., Los Angeles 43, Calif.



Lamp Socket

A new type Circline lamp socket has been developed. A feature of this connector is its "pressurized" type contacts. These make a wiping contact on the Circline lamp pins, and being moulded into a flexible Vinylite housing, adjust sufficiently to assure positive contact on all four contacts at all times. Socket is made with two types of lead construction: four conductor cord with a white jacket stripped 1 inch and individual conductors stripped ½ inch; and four individual leads (two black, one white, one blue) stripped ½ inch and covered with a white thermoplastic sleeving 6 inches long held securely in socket body. Overall lead length is 12 inches and all leads are rated at 600 volt. Socket is listed by Underwriters' Laboratories with a rating of 660 watt 250 volt. Monowatt Incorporated, Providence, R. I.



Motor Starter and Contactor

A new magnetic motor starter and magnetic contactor designed to give maximum protection to a-c motors up to 50 hp., 440 volt, has been developed. Two features are the relay heaters and plastic-encased coil. The bi-metallic relay heaters will follow the heating curve of the motor. Relay adjusts for automatic or manual reset when a lever is moved. Plastic-encased coil gives protection from moisture, corrosion and abrasion. It has a permanent, self-lubricating composition impregnated into the plastic that will keep the magnet guides sliding smoothly. Trumbull Electric Manufacturing Company, Plainville, Conn.

Motors

The drip-proof design has been applied to polyphase motors in the 254, 284, 324 and 326 frames. Motor frames are formed of heavy rolled steel, shaped to accurately center the stator core and to provide passages between the frame and the core for ventilation. An auxiliary fan, larger in diameter than the armature of the motor, draws in air through the openings in the front endplate, forces it through passages and out through endplate openings on the drive end. Screens on endplate openings give added protection. Both sleeve-bearing and ball-bearing motors of the new design are drip-proof when mounted in the normal horizontal position and when endplates have been correctly rotated. Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis 14, Mo.

Fittings for

- thinwall conduit
- rigid conduit
- metallic and non-metallic cable
- flexible steel conduit
- service entrance cable
- grounding devices
- lighting fixture fittings

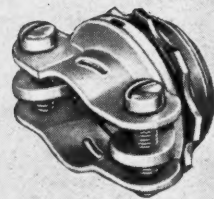
manufacturers for over 30 years

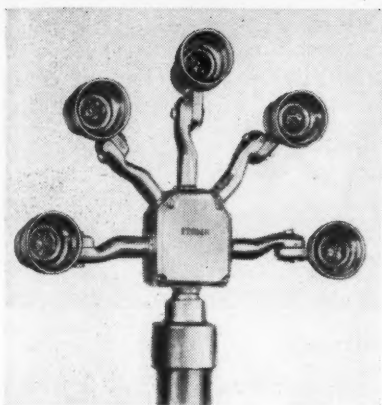
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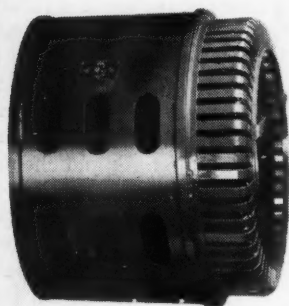
midwest





Lampholder

A new cast aluminum lampholder, known as Steberlite, for PAR-38 and R-40 lamps has been announced. The line consists of three basic units—the lampholder, an adapter box for a cluster of up to five holder units, and a pole slip-fitter for use on either a 1½ or 2 inch pipe. In addition, there is a line of accessories consisting of wall and outlet box fittings, a housing to eliminate spill light, bafflelouvers and color equipment. It is listed by Underwriters' Laboratories and features enclosed wiring for weatherproof construction. Mounting nipple is threaded ½ inch for use with standard electrical equipment. Steber Manufacturing Co., Broadview, Maywood, Ill.



Induction Motor

A new line of extra-low starting kva. squirrel cage induction motors has been announced. Called Design X, they are available in flange-mounted type and coupled two-bearing type for direct coupling to 514, 600 and 720 rpm. air compressors. Line permits full-voltage starting (across-the-line) with a starting kva. of 425 percent. Full load speed, efficiency and power factor are the same as that of the present E-M line of NEMA type B, low-kva., normal-starting-torque squirrel-cage induction motors. Electric Machinery Mfg. Company, Minneapolis 13, Minn.

Single-Phase Control

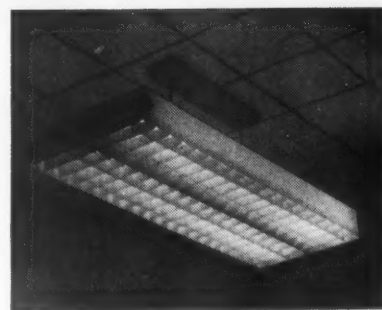
A single-phase to single-phase low frequency electronic welding control has been announced. This control is a frequency converter which, by means of electronic tubes, converts current at line frequency to current at lower frequency. The complete unit consists of three basic components: (1) a sequence panel which coordinates electrical functions of the control with the mechanical functions of the welder; (2) a frequency control circuit which transforms line frequency into a lower frequency; and (3) a weld timer which times duration of the welding current. The control is designed for connection to a resistance welding machine having a specially constructed transformer with a center tapped primary. Operation of the control is such that current is passed in one direction through the primary for four half-cycles, stopped and then reversed for four half-cycles thus producing a low frequency alternating current on the output side of the transformer. Westinghouse Electric Corporation, 306 Fourth Avenue, Pittsburgh 30, Pa.

Switch

The Press-On switch, a centrifugal device to replace both the governor and contactor on all makes and models of split phase and capacitor motors up to ¾ hp. has been announced. It is a self contained unit that presses on to the motor shaft, taking up no more space than an average governor. Complete Reading Electric Co., Inc., 100 South Jefferson Street, Chicago 6, Ill.

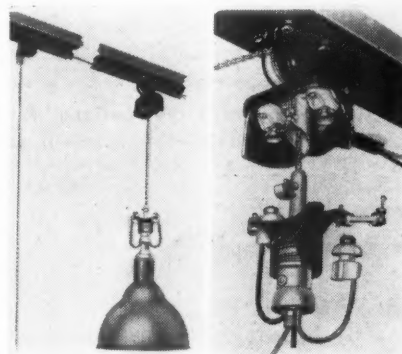
Relay

A new Form A drawout relay with a number of features designated to simplify maintenance and application has been announced. It is suitable for either semiflush or surface mounting. Cover attaches to case, so that relay unit can be removed and cover replaced, preventing accumulation of dust within the case or accidental contact with exposed circuit elements. Improved cover screws are self-centering and easy to start. Screws for the semiflush mountings are inserted from the back of the panel into the threaded bosses on the mounting flange, so that cover protects and conceals them. Reset button is carried within the cover. General Electric Company, Schenectady, N. Y.



Fluorescent Unit

A new fluorescent unit designed for school room lighting has been announced. It is known as "Seminar" and uses two or four 40 watt fluorescent lamps. Units are for individual or continuous run mounting. It has hinged louvre for easy maintenance. Starter or instant start high power factor ballasts. Side panels are plastic or glass. Fixture carries Underwriters approval. R & W Wiley, Inc., Dearborn and Bridge Streets, Buffalo 7, N. Y.

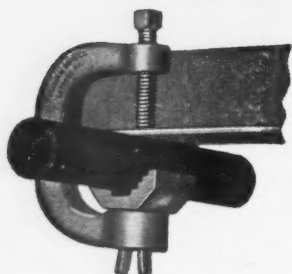


Hanger

Model No. L-141 disconnecting and lowering hanger for use with all types of high level lighting fixtures located 16 or more feet above floor level has been announced. A remotely-controlled, latching type, overhead, disconnecting switch combined with a fixture lowering and raising device, permits lowering of lights for cleaning, lamp replacement, or repair. A complete hanger installation consists of upper and lower assembly units, length of chain or cable for lowering and raising lighting fixture, positive locking device, and a pulley. Hangers are available for both indoor and outdoor installations using incandescent, fluorescent, or mercury-vapor lighting. They are Underwriters' Laboratories rated at 15 amp. 600 volt a-c, 30 amp., 250 volt a-c and 20 amp. 250 volt d-c. The Thompson Electric Co., 1101-57 Power Avenue, Cleveland 14, Ohio.

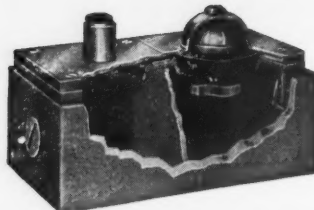
FULLMAN *Latrobe* PRODUCTS

★ FLOOR BOXES ★ WIRING SPECIALTIES



**No. 470, "Bull Dog"
Pipe or Conduit Hanger**

Made of highest grade malleable iron, this sure grip Bull Dog hanger is economical and dependable. Hangs pipe or conduit 1/2", 3/4", and 1" to steel beams 3/8" thick.



No. 252-R Two Gang Box

This Two Gang Adjustable Box has our own No. 208 Receptacle in one section. Has minimum of parts with maximum of efficiency. 1/2" Flush Brass Plug with one Cover Plate; 2" Flush Brass Plug with other.

QUICKLY INSTALLED . . . SURE SERVICE

There are no excess screws, wires or complicated parts in "Latrobe" Floor Boxes and Wiring Specialties. Their design and mechanism is simple, sure and compact.

That is why "Latrobe" Products are so quick and easy to install—so efficient in service.



No. 150 Box—No. 207 Nozzle

An adjustable, watertight box for dependable service in concrete or wood-finished concrete floors. 4 1/4" Cover Plate No. 242 and large Adjusting Ring No. 215.



**No. 110 "Latrobe"
Watertight Box**

The No. 110 "Latrobe" Box is extremely simple and compact in design, making for speedy installation and smooth service. Has 208 Receptacle and Cover Plate 3 1/2" diameter.

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**"Bull Dog"
BX Cable Staples**

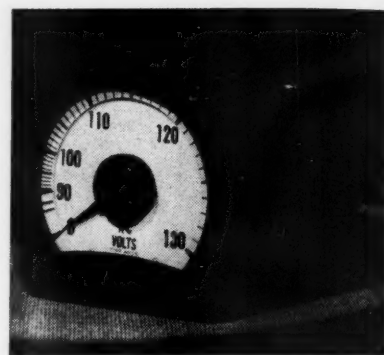
Favorites in every section of the United States, "Bull Dog" high quality staples can be ordered in cartons, kegs or barrels: 2500, 6000, 30000.



**"Bull Dog"
Insulator Supports**

Famous "Bull Dog" Supports can be completely trusted for fastening porcelain or glass insulators to exposed steel framework. Four sizes, from 1" to 2 1/2".

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA



Voltmeter

A new indicating voltmeter with an expanded scale has been announced. Designed for general switchboard use by electric utilities and large industries, the meter has a scale 7.1 in. long spanning 250° about the center. Scale is expanded over the most frequently used range, from 90 to 130 volts, enabling easy detection and measurement of 0.5 volt variations within that range. Although available in only one rating, 0-90 to 130 volts, it can be supplied with scales applicable to potential transformers for voltages higher than rated. It is housed in a dustproof, liquid-resistant case. Dimensions are 4 1/4 by 4 1/4 by 6 3/9 inches. General Electric Company, Schenectady, N. Y.

Conduit

Development of a neoprene-covered, flexible-shielding metallic electrical conduit for a wide variety of industrial operations has been developed. Featuring a neoprene coating applied through a specially developed process to give natural bond of rubber to metal, the Flexpansion conduit eliminates any danger of wiring damage by action of oil or grease. Conduit and couplings are liquid-proof, air-tight and chemical resistant. Industrial applications of conduit include machine tool wiring, chemical plant wiring, paper mill wiring, underground conduits for public utilities companies. Flexpansion Division of the Techniflex Corporation, 55 Jersey Avenue, Port Jervis, N. Y.

Ladder Stage

A new "Safety" ladder stage designed for use with an ordinary extension ladder, provides a safe working area or scaffolding unit for all above-ground operations where ladders can be used. It gives a working area of 26 by 24 inches. It is portable and convenient to handle. Frame is fabricated of structural aluminum alloy. Footboards are of seasoned waterproof wood and are slotted for easy width adjustment. Juniata Company, Park Building, Pittsburgh 22, Pa.

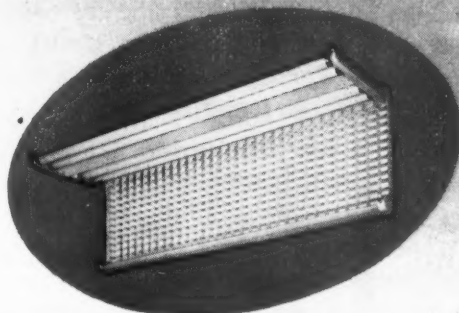
*-newest addition to Electro's famous
BASIC UNIT SERIES—the BASIC UNIT
principle that meets ALL commercial
requirements, cuts your inventory in half, speeds
turnover, lifts profits "Sky-High."*

* SKYLOUVER



*Trade Mark Reg. Applied For

No. 1045—4-lt 40 watt (1040 Basic+Kit No. 5)
No. 1025—2-lt 40 watt



{ Also available with bottom panels of ribbed
diffusing glass—"Sky-Ray" Model No. 1046
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- Outstanding Electro engineering and ingenuity, combined with the latest development in modern plastic molding, bring you a new wafer-thin, extremely shallow type louvered luminaire
- This revolutionary louver has 416 apertures, 1" x 1½", molded of heat-resisting, non-warping, durable polystyrene, provides a cut-off of 45° crosswise and 30° lengthwise
- Louver is held in a metal, basket-like, hinged frame that permits exceptionally low cost maintenance. Readily removable for quick, easy cleaning. Crescent shaped side panels are available in ribbed plastic or metal
- Available in 4-lamp 40 watt and 2-lamp 40 watt, Surface or Pendant mounted
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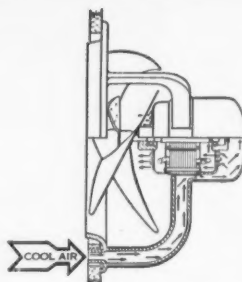
NEW TYPE "Q"

SELF-COOLED MOTOR PROPELLER FAN



VENTILATION

It's NEW from motor cover to frame, yet it's proved in thousands of installations! Certified ratings testify to remarkable capacity. Decibel ratings vouch for amazingly quiet operation. All ILG's famous features for high efficiency, power-saving economy, minimum maintenance and long life are built in. Now available in all sizes up to and including 30" fan wheels. Hurry—get the complete story in ILG Catalog No. 148—send coupon or phone nearby Branch Office (consult classified directory).



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Fluorescent Lamp

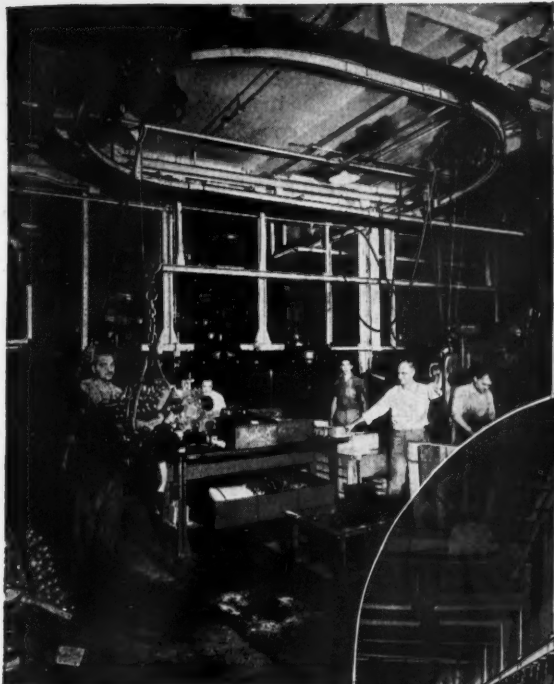
Users of fluorescent lamps can now obtain economical operation without loss of lighting efficiency as a result of a change in the construction of Sylvania's 100 watt 60 inch T17 fluorescent lamp. The newly revised T17, 2½ inches in diameter, consumes only 85 watts of energy when operated with standard 100 watt ballasts and auxiliaries. Since no changes have been made in physical dimensions, the 85 watt lamps are interchangeable with 100 watt lamps in all 100 watt fluorescent fixtures. Available in daylight, 4500° white, white, soft white and Warmtone. Present starter types FS-6, FS-64, COP-64 will operate either 85 or 100 watt lamps. Sylvania Electric Company, 500 Fifth Ave., New York.

Motor-Generator

A motor and generator assembly which permits obtaining five or six different frequencies of a-c simultaneously has been developed. Motor runs at synchronous speed. A silent chain is used to transmit power to each of the generator shafts and by proper selection of gear ratios each generator is driven at the necessary speed to obtain the desired frequency. Capacities of the generators is 150 watts at each frequency. This machine is for telephone exchanges where it is necessary to have five different frequencies to permit selective ringing of telephones on party lines. Kato Engineering Company, Mankato, Minn.

Antenna Rotator

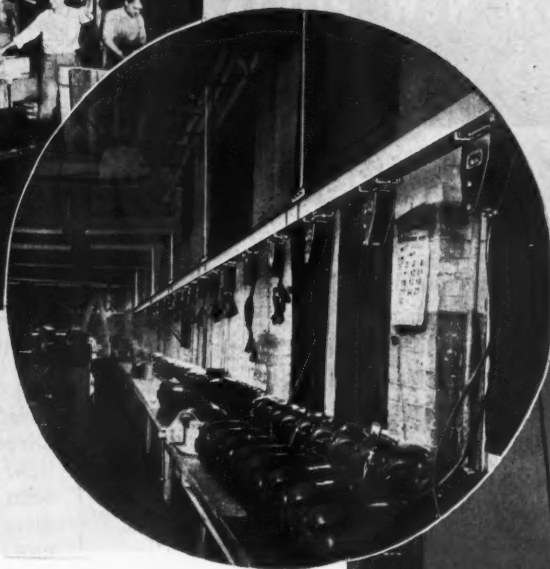
An electric antenna rotator called "Tenna-Rotor", designed to rotate the beam antenna in FM, television and other high frequency radio applications has been announced. Unit operates in any weather and is connected to a plastic control box, located adjacent to the receiver. A three position switch starts rotating the antenna clockwise or counter-clockwise, through 365°. When switch is turned to the center or neutral position, rotation is stopped. When limit of travel is reached in either direction, a small screen on the control panel is illuminated. The rotator mechanism is an electrically driven rotating hollow shaft into which the antenna center post is clamped. The gear train driving this shaft is motivated by an intermittent duty, reversible, capacitor type motor. Gear reduction is so designed that the antenna rotates at approximately 1 rpm. Alliance Manufacturing Co., Alliance, Ohio.



Overhead

On Test

*On the
Production
Line*



**IF IT
MOVES
it should be
FEEDRAIL**

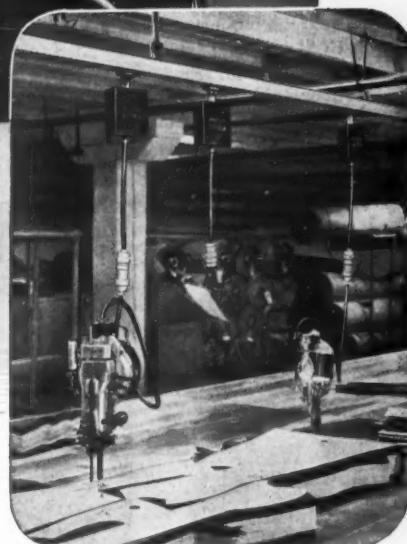
Ask any electrical maintenance man. He will say half his time is consumed in the repair of loose or exposed wires, and broken or faulty connections. Ask any safety man. He knows moving electrical equipment is one of the worst hazards in the plant.

Then install Electric Feedrail, the modern, totally enclosed electric distribution system. Watch men work with portable tools connected to the overhead trolley with Ever-Lok trouble-proof connectors. See what it does for moving test lines, lights, cranes and hoists. Everywhere it speeds production, saves maintenance, and reduces electrical hazards.

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*On the
Bench*



26

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No. 505

All Purpose Service Light
... with a hundred and one uses

The NEW McGill 505 All Purpose Service Light is equipped with concentrating lens to focus light where you need it most. Concentrating lens make light from 100 watt bulb $6\frac{1}{2}$ times as bright at two feet . . . doubles the intensity at eight feet. Simultaneously, the adjustable rotary reflector spreads ample illumination. Equipped with handy wire bracket stand the 505 can be used on the floor and easily positioned through a full horizontal swivel and 270 vertical arc to focus light conveniently at any angle. With stand removed the 505 can be mounted on wall or ceiling. Ruggedly built of heavy zinc plated steel wire, electrically welded. Handle is polished hard wood. The 505 is equipped with LEVOLIER switch and 25' of oil and grease proof Vynl Thermoplastic cord and plug.

PORTABLE GUARDS FOR EVERY REQUIREMENT

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No. 7100SR—Most popular design all - purpose guard. Rubber handle. No-Rol cage.

No. 3006 Vapor-proof — Water-tight and moisture proof. Light weight. Heat resisting globe.

No. 8025 Service Light—Wood handle, Thermoplastic cord and plug. No-Rol cage.

No. 151-CA Lamp Changer — Head with angle adjustment. New insulated interchangeable 5' section steel poles.



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ONLY McGILL MAKES Levolver SWITCHES

Battery Chargers

Development of a new line of electronically controlled and regulated floating battery chargers, for power stations, communications and other applications requiring accurate control of floating voltage, has been announced. They are fully automatic in operation, have constant potential output, and are designed to maintain floating charge on battery group to within plus or minus one percent. Electronic overload protection is provided which automatically limits the current to the pre-set maximum value and prevents overloading of charger by reduction of terminal voltage below battery voltage. Other design features include simple compact controls having no moving parts or contacts, conservatively rated selenium rectifier, and convection cooling. Power Equipment Co., 55 Antoinette St., Detroit 2, Mich.

Lighting Fixture

A new fluorescent fixture has been added to this line. Known as "Dual-Direction" it provides a 60/40 ratio of light through louvered bottom and open top. 60 percent of the light is directed downwards and 40 percent upwards. Illuminated side panels eliminate the dark area. Fixture is made entirely of metal. Maintenance problems are minimized by hinged louvers, which can be opened from either side or removed for accessibility to tubes, starters and ballast. Fixture is for flush or suspension mounting, as individual units or in continuous row assemblies. It uses two 40 watt tubes and is approved by Underwriters' Laboratories. Compco Corporation, 2251 West St. Paul Avenue, Chicago 47, Ill.

Stacker

A new tilting type transtacker has been announced. The battery-operated hand truck is available in two models, single lift and telescopic. Both units are engineered to permit passage through standard seven-foot factory doors. Backward tilt of the Transtacker is a full 21 degrees safe cradling of the load. A five degree forward tilt simplifies load-spotting. Lift and tilt controls are in a central location. Capacity of telescopic unit is 3100 pounds for a load 28 inches long, 2600 pounds for a 36-inch load and 2100 pounds for a 48-inch load. It features a hydraulic lift motor and pump, a direct connected integral unit. Automatic Transportation Company, 149 West 87th Street, Chicago, Ill.

[Continued on page 179]

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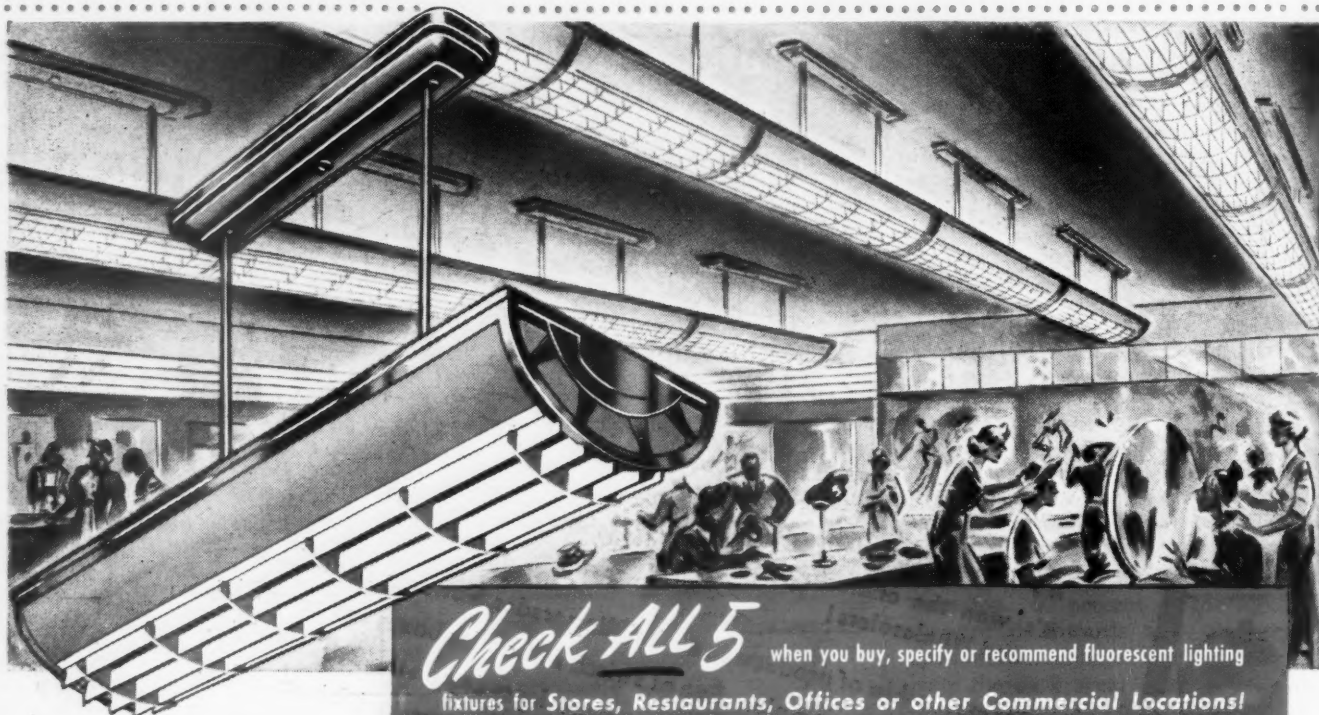
ALL-STEEL EQUIPMENT Inc.—800 Kensington Ave., Aurora, Illinois

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New, Beautiful **REX-LITE**

combines scintillating beauty
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40"



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fixtures for Stores, Restaurants, Offices or other Commercial Locations!

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Good Lighting-
Good Selling!*

With the new "Rex-Lite 40" Fluorescent Units, your commercial lighting plan has a distinct advantage of functional design beauty combined with a unique, soft, pleasing quality of light.

"Rex-Lite 40" pendant units are rated as a semi-direct unit with prismatic, polystyrene diffusing panel located above the two outside lamps which provide even distribution of the illumination in the upward zone.

"Rex-Lite 40" ceiling type units are rated as direct units with 5% of the light directed upward.

PENDANT TYPE DATA

| | |
|---|--------------------|
| Total unit efficiency | 59% |
| Total lumens above 90 degree zone | 24% |
| Side shielding | 27 degrees |
| End shielding | 13 degrees max. |
| Maximum brightness inside shielded zone | 1.7c/sq." (768FTL) |



FUNCTIONAL DESIGN

Eye-pleasing simplicity, streamlined styling, designed to harmonize with modern commercial decoration.



DIFFUSING ALL-PLASTIC PANELS

For uniform illumination... designed to relieve disturbing contrasts. These panels also reduce accumulation of dust and dirt inside reflector.



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Porcelain Enamel reflecting surface, unequalled for high light output with maximum diffusion. Finest quality ballast and starter equipment reduces annoying flicker and minimizes costly service interruptions.



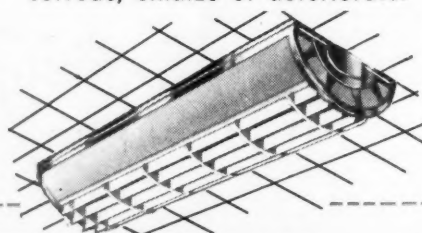
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"Rex-Lite 40" Units are available in pendant or ceiling units. Either type can be installed independently or butted end-to-end to form continuous lines by using a specially designed coupling.

CEILING TYPE DATA

| | |
|---|--------------------|
| Total unit efficiency | 52.5% |
| Shielding same as pendant unit | |
| Maximum brightness inside shielded zone | 2 c/sq." (904 FTL) |

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Renovating an Obsolete Primary System

How a 31-year old primary system at Burroughs Adding Machine Company, Detroit, was modernized to provide added capacity and utility stand-by service.

THE Primary System at the Burroughs Adding Machine Company, Detroit, as it existed up until several months ago, was designed in 1917. At that time it was a good model for an industrial plant. The system (Fig. 1) carried the plant through 31 years of operation with only four shut-downs and a total outage time of only eight hours due to electrical system failures.

In the 1930's plant management decided that further expansion in the Detroit location was limited by lack of space. The first units of an entirely new and modern plant in Plymouth, Michigan were built with the intention of gradually moving the Detroit plant there. The war prevented this move, and postwar shortages of building materials and equipment, plus sky-rocketing construction costs forced a further postponement of the original plans. Also, a tremendous influx of postwar orders for adding, calculating and accounting machines forced an increase in production even greater than their wartime records of the Norden bomb-sight and Sperry gyroscope parts production.

There was not sufficient generating capacity to provide for the increasing load and to allow proper maintenance of the 30-year old turbines and generators. In 1946, plans were made and bids taken for the addition of a new 3000 kw. turbo-generator and boiler.

However, delivery would not be made until sometime in 1948 and power was needed almost immediately, so a survey of the electrical system was made to determine the best and most economical method of bringing in stand-by service from the Detroit Edison Company.

The problem of locating a 1000 kva. stand-by substation and running cables and ducts was quite simple and it was

soon installed and in operation. However, the survey revealed that the system had not been designed to provide for the addition of more than 100 percent of its original generating capacity. The main oil circuit breaker,

By Nelson A. Kieb
Electrical Engineer
Albert Kahn Associated Architects
and Engineers, Inc.,
Detroit, Michigan

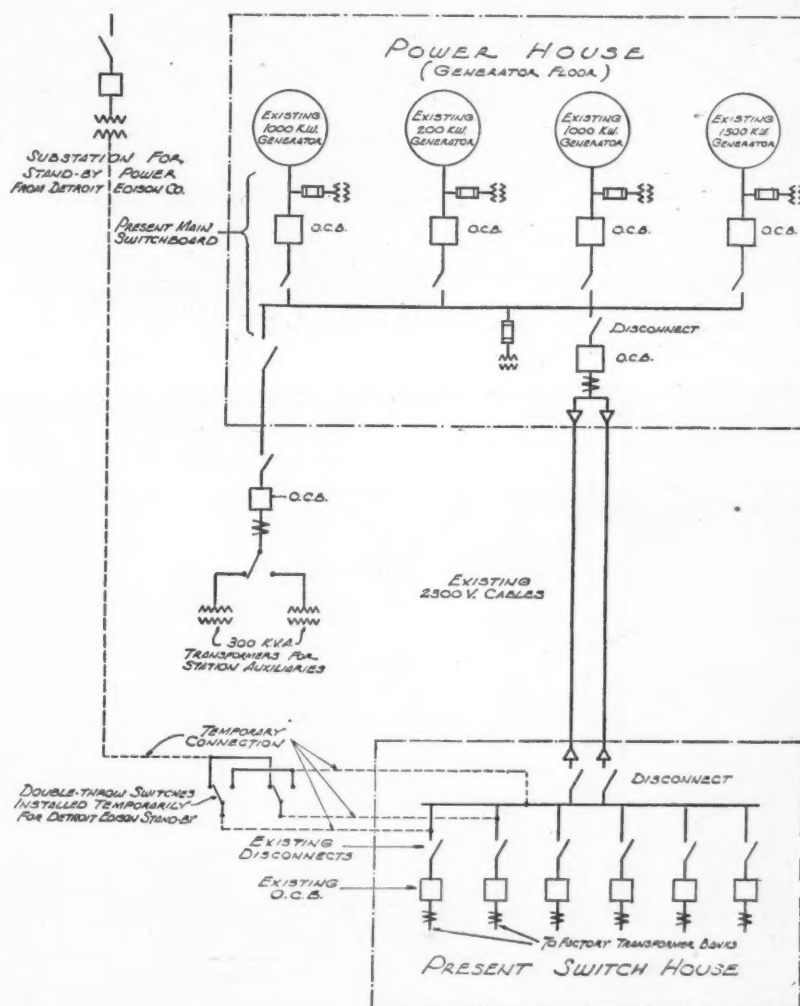


FIG. 1—One line diagram of the original primary system serving the Burroughs plant. Temporary utility stand-by service was added within past few years.

production of which was discontinued in 1926, had short-time current carrying capacity but was absolutely inadequate to interrupt the short circuit kva. that was available. The branch oil circuit breakers were inadequate both

in short-time current and short circuit interrupting capacity. All bus work was open, headroom clearance was not up to present-day requirements, and the main cables between Power House and Factory Switching Station were

subject to question after continuous operation and overload over so long a period.

After much study and consideration of many possible methods, the layout shown in Fig. 2 was chosen as the most economical and flexible means of providing for the needs of the plant. There is still a good possibility of the plant operations being moved to Plymouth in the next five or ten years, hence it was advisable to choose that equipment which could be easily disassembled, moved, and re-used in the Plymouth Plant.

For example: The Detroit Plant operates on 2300 volts, 3-phase, 60-cycle ungrounded while the Plymouth Plant operates on 4600 volts, 3-phase, 60-cycle ungrounded. Since 5000-volt switchgear is not practical for use on the 4600-volt Plymouth system, it could not be considered for use in Detroit, although it would have served the purpose, is much less expensive, and easier to obtain than the 7500-volt or 15000-volt rated equipment required for Plymouth. The turbo-generator was ordered with dual voltage so that it could be operated either on 2300 or 4600 volts. The short circuit ultimately available on the Detroit System will be approximately 75,000 kva. at rated voltage. In Plymouth it probably would eventually exceed 100,000 kva., and present equipment there now is rated for interruption of 150,000 kva. Thus the equipment for use in Detroit had to be capable of interrupting 150,000 kva. also.

At the time the study was being made, turbine delivery was scheduled for June 1948; deliveries on metal-clad switchgear were being quoted for December 1948 to February 1949. However, the War Assets Administration was disposing of some Allis-Chalmers modern, metal-clad, cubicle-type switchgear that contained many of the fundamental requirements of the Detroit and Plymouth Plants. This was purchased and delivered in three weeks time.

Modernization Steps

The first step in the process of renovation was to replace the obsolete main breaker, behind the original switchboard, to provide sufficient interrupting capacity. This was done over a week-end. One of the 1200-ampere, vertical-lift type oil circuit breakers from the cubicle-type switchgear was set on a temporary angle iron frame behind the old board and connected to the main buses and to the old main feeder cables. Overload relays were borrowed from the War Assets switchgear and connected to the old C.T.S., to trip coils on the breaker, and to a

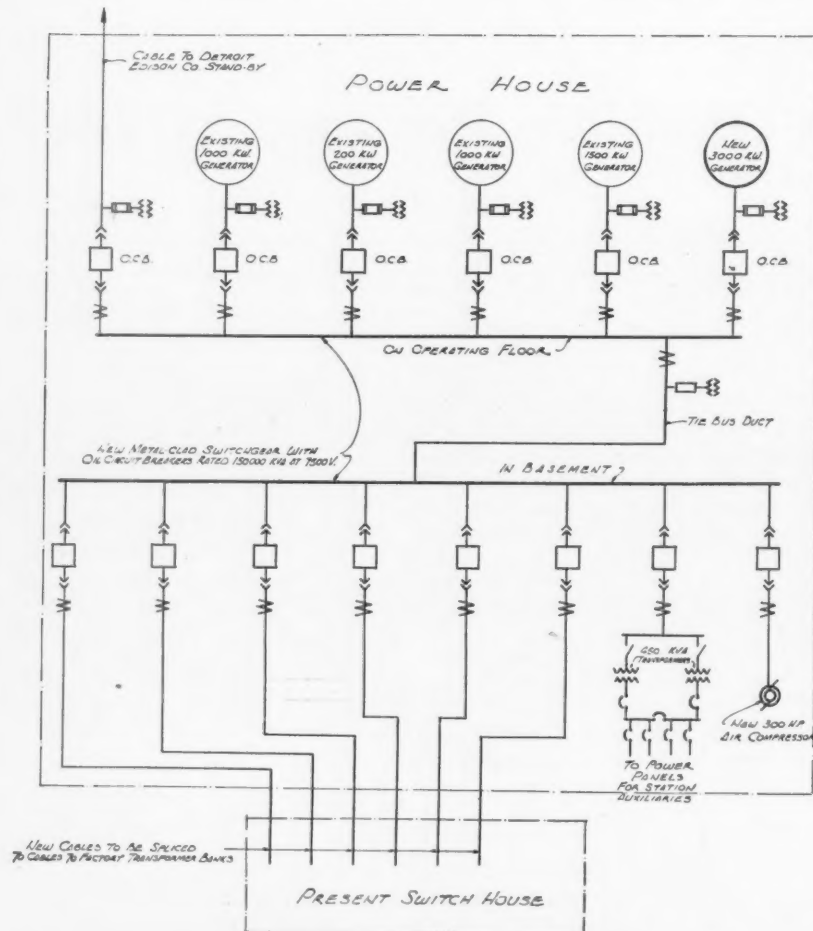


FIG. 2—Modernized primary system showing addition of new generator, permanent utility stand-by service, and modern generator and feeder cubicle-type switchgear.

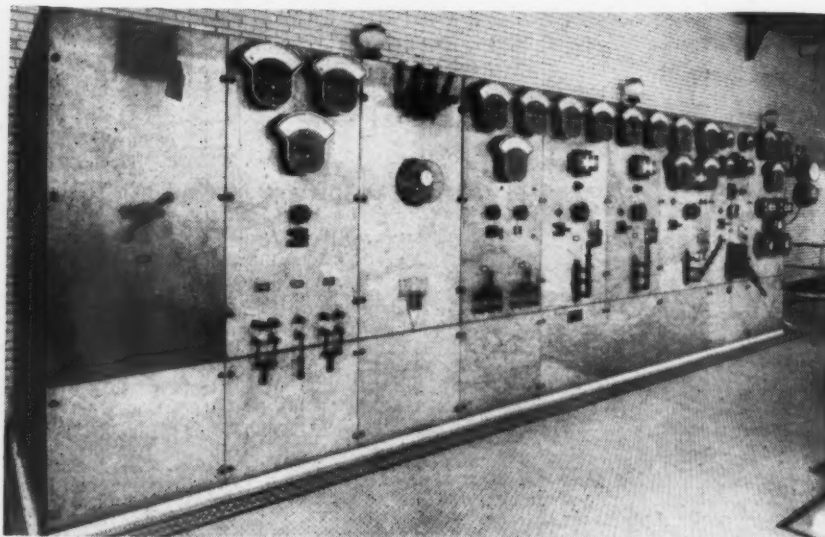


FIG. 3—Original generator control board gave 31 years of service with only four system shut-downs and eight hours of outage time. It will be replaced by modern metal-clad switchgear.

source of 120 volts d-c which was available from a Detroit Edison service. Closing and tripping were carefully checked, and the breaker was put in service. The trip coils of the breakers in the Factory Switch Room were disconnected, and all short circuit protection was centered upon the temporary main breaker.

The second step, finding space for the new switchgear, presented quite a problem. The original board, shown in Fig. 3, is at the south end of the operating floor and well-centered for the original generators, but too far away from the new unit for good operation. Also, the old board had to be kept in operation until the new switchgear was in operating condition. The only other space available on the operating floor is in the center of the building where the engineer's office is located (Fig. 4). This provides space only for the generator switchgear, so the feeder switchgear was installed in the basement.

The basement location (Figs. 5 and 6) is far from ideal. The only available space is crowded, existing overhead piping reduces headroom, temperatures are above normal, and it is difficult to keep things clean. But in modernizing an existing plant ideal conditions can seldom be obtained. The cost of re-locating piping and equipment usually runs so high that the whole project becomes too costly. Frequently, compromises must be made which allow conditions to exist that would not be tolerated in an entirely new plant.

To eliminate the need for a 2000-ampere main feeder breaker to protect the basement switchgear, the generator switchgear bus was tied to the feeder switchgear bus by means of a solidly connected 2000-ampere bus duct designed to have the same short circuit rating as the switchgear. Although headroom was very limited, space was found through which the bus duct could be run to join the two boards.

The third step was to determine what equipment had to be added to the purchased switchgear to adapt it for use in the Burroughs Plant. It had been designed originally to operate on 6900 volts from a 10,000 kva. bank of transformers. There were 16 modern cubicles in all, each complete with meters, relays, switches, etc., as well as two 1200-ampere vertical lift breakers and ten 600-ampere breakers.

From a one-line diagram of generator control, a list of equipment was made up and placed on order with delivery promised for approximately the same time as the turbine delivery (which in the interim, had been set back six months).

While awaiting delivery of generator control equipment, a contract was let to set the basement feeder switchgear, run a temporary main feeder to it from the temporary main breaker behind the old switchboard, and install feeder cables and conduits to the old Factory Switch Room. The old inadequate circuit breakers in the Factory Switch Room are to be removed and the new feeder cables neatly racked around the room and spliced to the existing cables running to Factory loads. The old main feeder cables to the Factory Switch Room are to be disconnected and removed.

The fourth step, renovation of the

source of power for the station auxiliaries, is still in the planning stage. Originally one bank of 3-100 kva. transformers was located in the basement. When the 1500-kw. generator and additional boiler capacity were installed some years back, their auxiliaries required the addition of a 300-kva. transformer outside the north end of the building (Fig. 7). Primary and secondary connections on these two banks of transformers were set up so that limited flexibility of the two banks was obtained. The inside transformers could not supply their full capacity because of lack of ventilation and there were a number of other features about

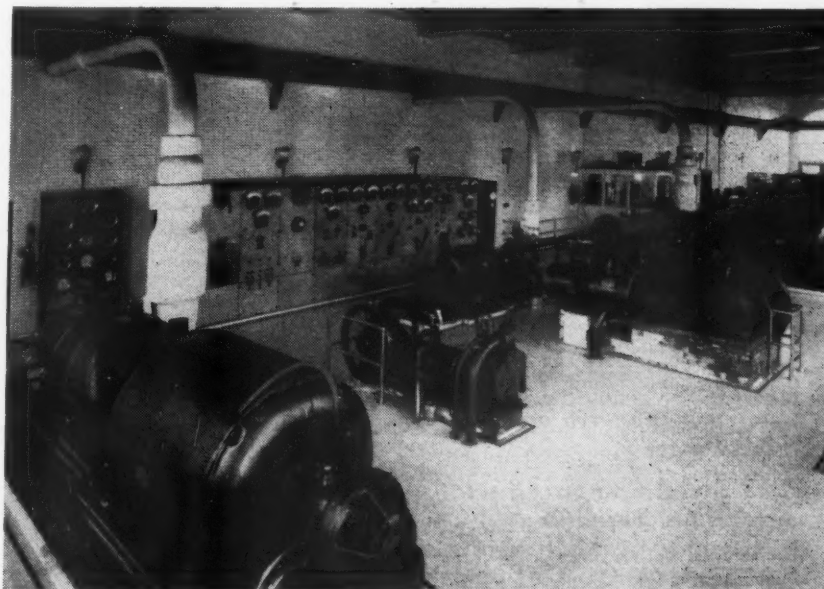


FIG. 4—Power house generating floor showing old generator board and engineer's office at right where new generator cubicles will be located.



FIG. 5—New feeder switchgear being installed in power house basement area. Generator tie-bus duct will drop down above large steam pipe at right.

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the installation that left it far from desirable.

However, the transformers in the basement are of the outside type, and it is planned to move them to a mat adjacent to the 300-kva. transformer, provide oil disconnect switches outside ahead of both banks, and run one primary feeder from the new switchgear to both transformer banks. The secondaries will be run back inside the building to air circuit breaker type metal-clad switchgear located as near the point of entrance of the buses as space will permit. New feeders will be run to new secondary power panels replacing old open-type secondary switchboards which were part of the original installation.

Normal operation of the secondary switchgear will be with the tie breaker open because the two transformer banks do not have exactly similar characteristics. But, under emergency conditions, it will be possible to parallel for a few minutes while switching or

to carry the entire load of about 450-kva. on either bank for a short time.

The last step will be the re-building of the new generator switchgear with the installation of the parts, instruments, and connecting bus duct that are now on order. The 3000-kw. generator will be connected first. As soon as it is in operating condition, it will take over most of the load, and the other generators will be cut over one at a time. The Edison Stand-by service will be run in to its breaker where it can be paralleled with the generators or operated independently to the extent of its capacity during a shut-down of the generators.

The final result will be a modern and flexible primary system with adequate protection for both generator and feeder equipment. The cost will be approximately the same as if new switchgear designed for the purpose, had been purchased. But, it was felt that valuable time was saved by the use of the readily available switchgear.



FIG. 6—One section of feeder switchgear in power house basement showing station transformers (outdoor type) at right which will be moved to outdoor mat.

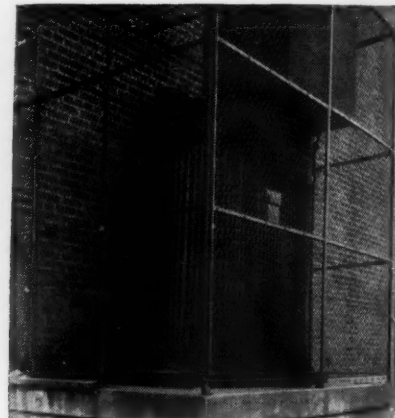


FIG. 7—Outdoor station transformer of 300-kva., 3-phase capacity will remain. Inside station transformers (three 100-kva. units) will be installed on adjacent mat.

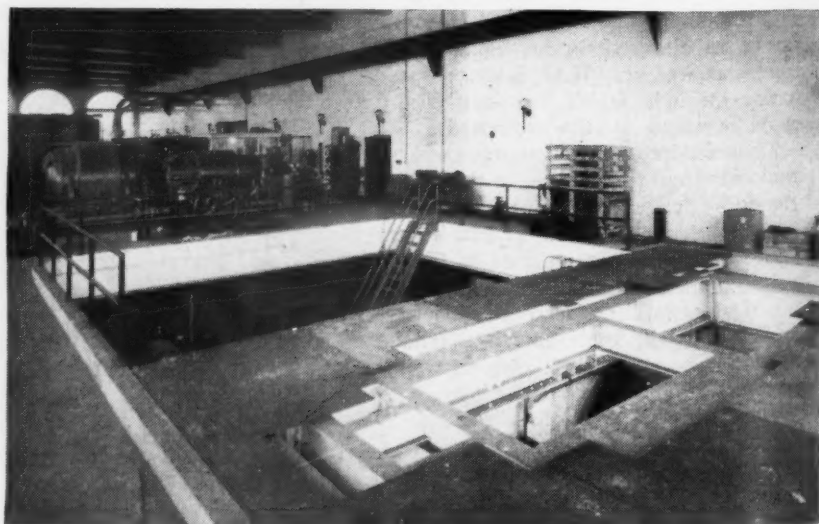


FIG. 8—Well opening and foundation for new 3,000 kw. generator on power house generating floor. New control board will be located by engineer's office in background.

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Century 1/2 horsepower
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QUESTIONS from readers on problems of industrial equipment, installation maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

Reader's Quiz

Circuits for Fluorescent Fixtures

Q QUESTION 306—We would like to know the internal circuits for two lamp fluorescent fixtures to be operated on direct current. What are the basic differences between these and those used on a-c?—H.S.

A. TO QUESTION 306—With reference to the two-lamp fluorescent operation on d-c circuits, you do not indicate what wattage lamps you are interested in.

On 110 volt circuits d-c, you can operate two 14 watt fluorescent lamps in series using an S-11 lamp as a ballast. Circuit No. 1 shows this and it is used in fluorescent desk lamps, etc.

Should your interest lie in the use of 40 watt lamps, this is a different matter. Here we use a d-c ballast and in series with the ballast a resistance of approximately 336 ohms. For d-c current a reversing switch is used once or twice a day so that tubes do not blacken on one end. Circuit No. 2 shows a diagram for one 40 watt lamp. Where two are used parallel, another circuit to this one bearing in mind each lamp has its own ballast and resistor.

In closing, want to say that there is a circuit for 2 lamp application in

which you can use a conventional a-c type ballast. Thus, you can change an a-c fixture to a d-c one. Or where you have d-c at present, you can buy regular a-c equipment and when you change over to a-c you can use the same equipment. Again each tube has about 325 ohms in circuit and for d-c operation, the capacitive part of the ballast as well as the compensator is not connected in the circuit. I also show this diagram under No. 3.—E.A.M.

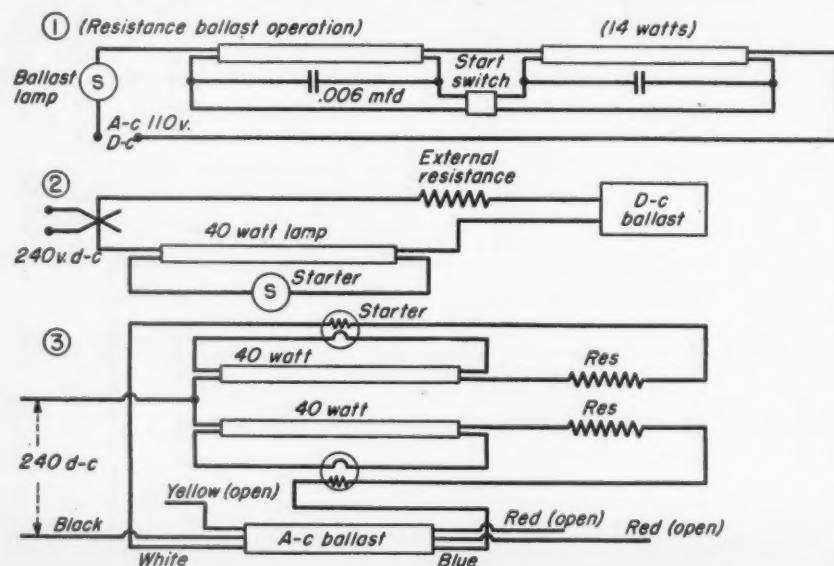
A. TO QUESTION 306—It is difficult to operate fluorescent lamps on d-c unless supply voltages are suitable. A resistance of the correct value and rating must be connected in series with each lamp in addition to the normal choke, starting switch and radio suppressor capacitor. To overcome the tendency of the mercury vapor to collect at one end and reduce the light output at the other end a polarity reversal switch should be used. Each time the lamps are switched on, the polarity will be changed over.

80 and 40 watt lamps are difficult to start on voltages less than 220 d-c but the 15 and 20 watt sizes give fairly good results on 120 and 110 volts. For 120 volts 198 ohm resistance should be used for the 15 watt lamps and 144 ohms for the 20 watt lamps. On 110 volts the figures are 165 and 112.

Two 14 watt, 15 inch lamps can conveniently be used on 120 volt, direct current. A resistance ballast lamp type S11, rated at 0.5 amperes is quite suitable. It uses about 17 watts. It must be realized however that on say 120 v. d-c some 21 watts is consumed on the auxiliaries for a 15 watt lamp thus bringing the overall efficiency down to that of a tungsten lamp.—C.R.B.

A. TO QUESTION 306—D-c fluorescent fixtures must use a series resistance which will limit the voltage to that recommended by the lamp manufacturers, 20 watt lamps will require 110 volts. 40 watt lamps will require 220 volts. 40 watt lamps should use a polarity changing switch, as otherwise one-half of the lamp will soon get dark. Some fixture firms use an inductance in series with the resistance to improve starting.

Sylvania makes a 20 watt d-c lamp which starts faster than an ordinary 20 watt lamp. D-c wattage is very high due to the power lost in the resistance. A d-c fixture will work on a-c. An a-c fixture will not work on d-c, because d-c is not choked by the inductive ballast used on 20 watt lamps. 40 watt a-c ballasts use a transformer which will burn out on d-c.—H.S.



Transformers

Q QUESTION 307—Will two transformers connected open delta supply you with three E. M. F.'s, 120° apart the same as a three phase generator?—W.H.L.

A. TO QUESTION 307—The answer to your question is yes, so far as the position of the phases and the voltage is concerned. There is a slight error in both but not enough to interfere with the operation.

The only difference is in the load carried by the two remaining transformers, the current in each of these increases to 3 times the value it would be if there were three transformers in closed delta, carrying the same load.

If a balanced load of 300 kva. was



1 1760—A strong back, sharp axe and plenty of time and patience were a must for the frontier homebuilder. He cleared the land, felled his trees, hewed logs to fit and hoped his house wouldn't leak when he finished.



2 1875—Lumber, the universal building material, was a budding industry. But woodworking machinery was hard pressed to keep pace with the tremendous demand. Urgently needed was low cost electrical power to boost output.



3 1915—Howell "Red Band" Electric Motors appeared. Applied to machines in woodworking and other important industries, these rugged, industrial type motors soon won wide recognition for making good on tough jobs.

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4 Today—Electrically powered machines work wonders with wood. This modern moulder, for example, using 5 Howell Industrial Type Motors, can shave, trim and form four sides of a wood strip at the rate of 225 feet every minute . . . job costs are cut . . . more people enjoy more goods at less cost.

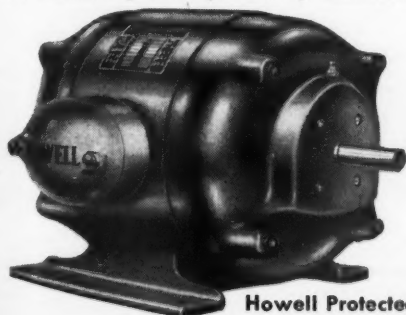
Here's another example of a tough industrial job solved by Howell Motors—the accepted industrial type motor.

Whether it's on planers, moulders, saws, lathes, pumps, fans, conveyors or dairy equipment, dependable, precision-built Howell Motors are an important source of power.

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Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.

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"About three months ago a primary fuse on the pole blew and threw our entire plant on single phase. At the time our plant was running full force, which meant there were approximately 300 motors running.

"Most of the motors were protected with relays or thermals, backed up by Fusetron fuses. The rest were protected by Fusetron fuses alone.

"As quickly as we realized the single phase condition existed, the main switch was pulled.

"By that time many Fusetron fuses had blown — but we didn't lose a single motor.

"Fusetron fuses more than paid for themselves that day even though we had but a short time previously gone to the expense of making a complete installation throughout the entire plant."

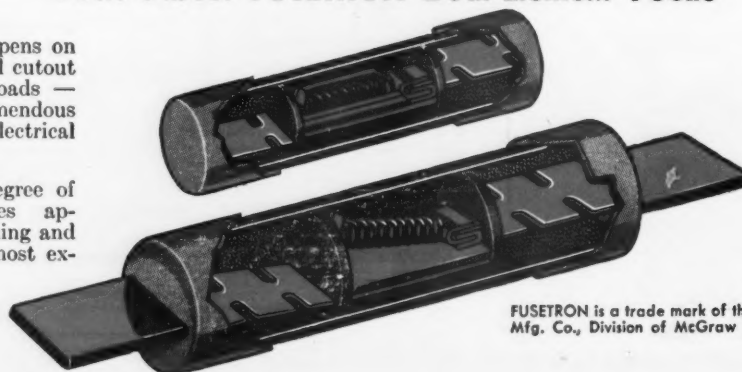
. . . Chief Electrician,
Twin Coach Co., Kent, Ohio

..” Thanks to

Facts About FUSETRON Dual-Element FUSES

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.



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Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

Fusetron DUAL-ELEMENT Fuses

with their

10 Point Protection

- 1** Protect against short-circuits.
- 2** Protect against needless blows caused by harmless overloads.
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- 4** Provide thermal protection — for panels and switches against damage from heating due to poor contact.
- 5** Protect motors against burnout from overloading.
- 6** Protect motors against burnout due to single phasing.
- 7** Give **DOUBLE** burnout protection to large motors — without extra cost.
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- 9** Protect against waste of space and money — permit use of proper size switches and panels.
- 10** Protect coils, transformers and solenoids against burnout.

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Give ALL-PURPOSE PROTECTION**



One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

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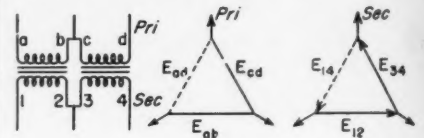
being drawn from three 100 kva. transformers connected closed delta, the removal of one transformer would cause each of the remaining two to carry 173 kva. for the same output.

It would therefore be necessary to reduce the load on the bank from 300 kva. to $(100/173)$ times 300 or to 173 kva. to prevent overloading the transformers.

This connection is used where the load is increasing and two are installed with the intention of installing the third as soon as the load reaches 1.73 the times rating of one of the transformers.—A.E.T.

A. TO QUESTION 307—The voltages on the secondary side of an open delta connected bank of transformers are 120 degrees apart and make a true three phase system.

Reference to the connection diagram and its vector indicates the voltage E_{ab} on the primary side is maintained by the system, it is equal to the other voltages and 120 degrees from them.

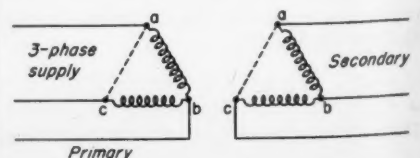


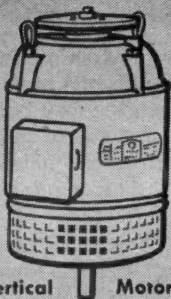
Therefore, the secondary E_{ab} and E_{12} are 60 degrees apart and from a voltage E_{ab} which is equal to them and 120 degrees from them under no load conditions.

However, when a load is connected, the voltage triangle is distorted due to the leading and lagging currents in the transformers, since the internal power factor of the two transformers is 86.6 percent when the load power factor is unity.—R.J.M.

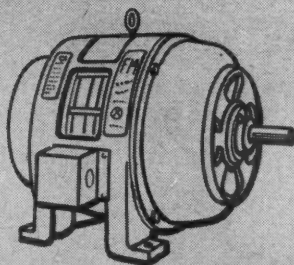
A. TO QUESTION 307—Yes, provided the primaries are connected to a 3-phase source. In diagram the connections would be represented as below.

The 3-phase supply has the 3-phases 120° apart and the secondary will generate voltages ab and bc , 120° apart. The third voltage ca will be obtained when the voltages ab and bc are added vectorially. A load can be drawn from ca the same as from either of the other pairs of conductors. The load current instead of flowing through a transformer ca must flow through transformer ab and then bc , the two being in series. The net voltage and current will be the same as if it were drawn

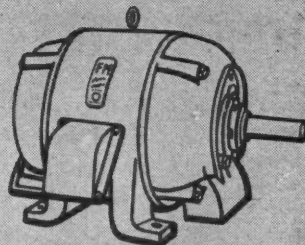




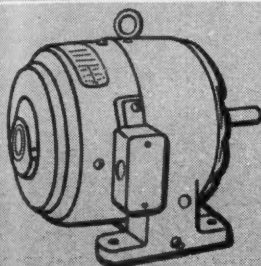
Vertical Motors



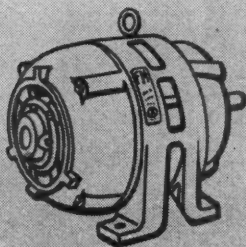
General-Purpose Ball-Bearing Motors



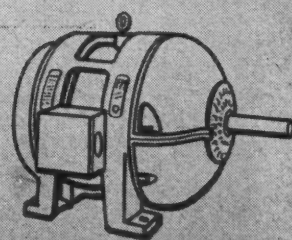
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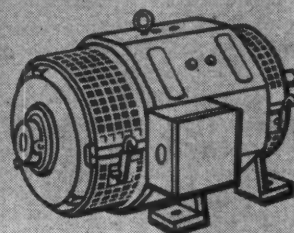
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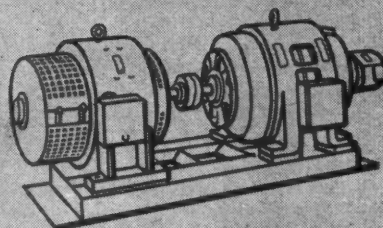
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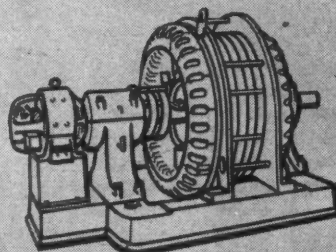
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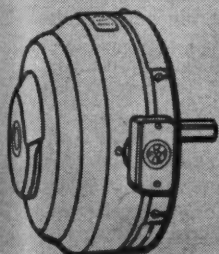
D.C. Motors



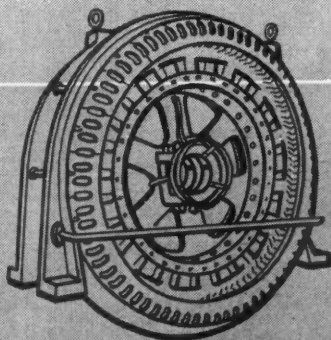
Motor Generator Sets



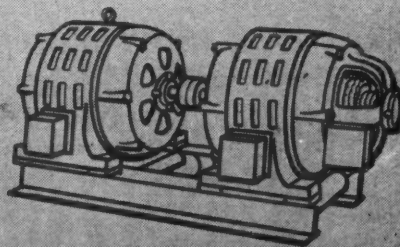
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directly from *ca*. Actually, the arithmetic sum of the currents in *ab* and *bc* will be larger than the load current *ca* as the currents are out of phase and when added together will not total the arithmetic sum. This effect is what gives two transformers in open delta only 57% of the capacity of three transformers instead of 66 $\frac{2}{3}$ %, as one might expect.—L.R.B.

Feeders for Power and Light

QUESTION 308—We are running 4 inch lay-in duct that will contain feeders for power and lighting circuits. The lighting circuits are switched at a panel located 200 feet from farthest lights. Could we run a large single wire the length of the duct to serve as a common return for all the lights instead of running a return line all the way to the panel for each lighting circuit?—A.S.

A. TO QUESTION 308—The question refers to a 4-inch duct containing feeders for power and lighting circuits. Below is a question as to whether it would be satisfactory to use a single large wire as a common return for all the lights instead of an individual return wire for each lighting circuit.

There are two conditions. The first is for feeders. It is permissible to use a common return wire (neutral), of adequate size, for two or three sets of 3-wire feeders or for two sets of 4-wire or 5-wire feeders. Section 2204 of the National Electrical Code permits this.

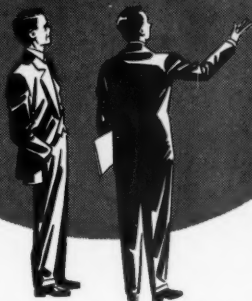
The second case refers to branch circuits. With a 3-wire system you may use 3-wire circuits each consisting of one ungrounded wire from each side of the circuit and one (neutral) grounded wire. It is not proper to use a common (neutral) return wire for more than one such circuit. Section 2113 of the 1937 National Electrical Code read: "A common neutral conductor may be employed for two or more branch circuits provided not more than eight ungrounded conductors are used."

Misunderstanding of the rule, resulting in improper construction and difficulty in enforcing the rule resulted in its repeal in 1940. Therefore, this method is not approved at present.—J.E.W.

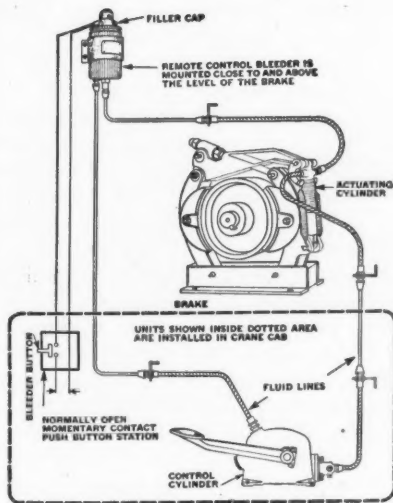
A. TO QUESTION 308—Section 2204 of the National Electrical Code states that one common neutral may be used for three, 3 wire single phase branch circuits, or two 4-wire,

“

that crane's
a 'smoothie'
now...”



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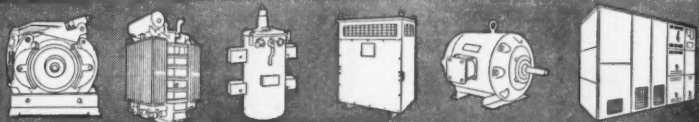
If you now have Wagner brakes, your system can be quickly modernized with our complete conversion kits. You can change your old solenoid-controlled HM brake to the compact, hydraulic type; you can convert a type H brake to an HM; and you can easily add the remote control bleeder to any Wagner system.

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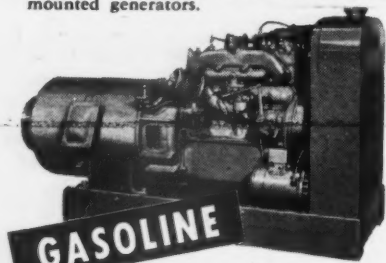


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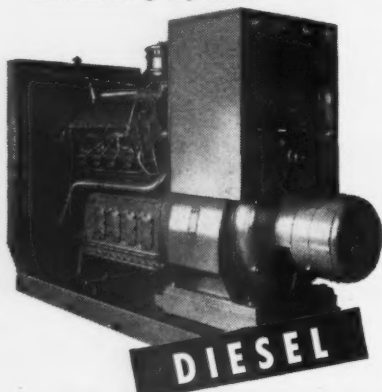
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three phase circuits, provided the neutral is grounded and all seven wires of the multi-wire circuit are carried in the same iron conduit. This allows six branch circuits for each neutral.

However, the neutral must be of sufficient capacity to carry the maximum unbalanced load possible of the multi-wire circuits. This in either case would be equal to the maximum load on either side of the three wire system or carried by one of the phases of the four wire system.

You could reduce the number of circuits by using 20 amp. circuits instead of 15 amp. provided this is possible with the switching desired. The actual amount of copper used would be about the same, but the labor would be reduced.

To reduce the amount of copper used it would be necessary to increase the lamp voltage to 220 volts. This would reduce the cross section of the copper to 1/4 of that required for 110 volt lamps and still have the same percentage voltage drop at the lamps. Theoretically, you could reduce the wire to 1/4 the original size. The size of wire thus obtained should be checked with table No. 1, chapter 10 of the N. E. Code, for capacity, and if too small, must be increased to comply with the Code.

The types of service available would have to be considered in deciding the system to be used. I would suggest that you consult the local inspector or the power company and get their consent to any arrangement of this kind.—A.E.T.

Magnet Cranes

QUESTION 309—We have five magnet using cranes. The power for these magnets comes through a heavy duty cabtire cable which is retrieved on a reelite mounted on the trolley of the cranes. We have been experiencing considerable trouble due to cable breakages, mostly either just above or below the hoisting hook to which the cabtire cable is terminated before going to the magnet. We have tried installing a lock to prevent the hook from turning, but while this helps, we still have cable breakages. I would like to know if any one has solved this problem.—T.J.H.

A. TO QUESTION 309—To get better service from your cabtire cables, remove them from the crane hook area. Terminate your magnet leads in a plug receptacle at the outer rim of the magnet; the plug should be in a protected place and turned with its opening down. The reelite should

be as far from the hoisting drum as the trolley frame will permit. You have now got your reelite cable at its maximum distance from the hoisting ropes and hook block.

Your magnet can now turn the major part of 180° in either direction before it fouls the hoisting ropes. Before putting the plug on the cable, pull the cable through a section of heavy duty air hose and fasten it firmly to the plug so that the cabtire will form a neat curve when the plug is inserted into its receptacle, the tension of the reelite spring winder will hold it firmly into the receptacle and the hose will protect the cable up to and beyond the hook block, depending on how long your hose is cut. Your cabtire will not rewind quite as far as before, since the hose will not pass through the reelite cable guides.

The tension of the cable will tend to minimize turning of the magnet. We have five overhead bridge cranes using this system on motor operated clam buckets and use 4 conductor, No. 8, rough usage cabtire cable. We find that the hook block flopping around, when the clam is dropped onto the material pile, pinches and cuts the cable. This will apply to a magnet to a lesser degree since it is not necessary to have slack hoisting ropes as is the case when clamming material from a pile.—J.B.

A. TO QUESTION 309—It is absolutely necessary to "pin" the hook in the block to prevent turning of the magnet and twisting of the lifting and feeder cables. On all of our magnet cranes we weld a 2 in. by 2 in. by 1/4 in. angle support on the block with cable clamp at the outer end to terminate the flexible feeder cable for the magnet. The tension of the feeder cable is thus anchored at this bracket and relieves the strain on the individual conductors to the magnet.

The outer covering of the feeder cable should be extended down beyond the cable clamp approximately 6 inches and then cut off to allow separation of the leads for the placing of the connectors. The length of the angle support should be long enough to provide clearance between the hoisting cables and the feeder cable, approximately 15 inches. We find that Type "S" "Tirex" and Type "W" work out very satisfactorily as feeder cables for our magnets.—M.M.

A. TO QUESTION 309—This problem interests me, as the plant where I am employed has just installed a crane where its power is fed through a cable and is retrieved on a reelite mounted on the cable.

I find that the center of the reelite reel is fed from a set of rings with

3
2
1



SELF-THREADING



**BRIEGEL METHOD
TOOL
CO.**
GALVA, ILLINOIS

129

Silicone News



What's Essential?

Buttons and bows may be essential to the little woman; a box of La Coronas may be essential to us. But that's a purely relative use of the word. For something that is absolutely essential we point to certain industrial motors... for example, pump motors that supply water to a processing plant. They're the kind of motors that deserve Silicone Insulation.



PHOTO COURTESY PURE OIL COMPANY

Both of the 10 h.p. motors which supply water to the Pure Oil Refinery at Midland, Michigan, are silicone insulated to assure continuous operation under adverse conditions.

These two pump motors are located in a sub-basement near a river that overflows every spring. Ventilation is poor and humidity is always high. Originally insulated with Class "A" materials, both motors failed the first time they were flooded out. They were then rewound with Silicone (Class "H") Insulation.

Pure Oil specified Silicone Insulation because it offers much more protection to motors exposed to excessive moisture. In several instances, silicone insulated motors that were submerged by flooding have been hosed off and put right back into service. Accelerated life testing and actual performance records have proved that this new class of insulation developed by Dow Corning has at least 10 times the life and 10 times the wet insulation resistance of the best insulating materials previously available.

Electrical maintenance and production men in all fields of industry are learning that Silicone Insulation is the best insurance there is for critical motors. For more information, call our nearest branch office or write for pamphlet No. G7-K.

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brushes. The only possible trouble would be there.

However, in your case, your reelite is of heavy cabtire cable. This must be protected with a coil steel spring, which is slipped over the cable and one end of the spring mounted firmly on the frame where cables enter the box or connector. This will help the cable when slack (or pull) is put due to the crane directions. This will prevent the cable from making a sharp bend, thereby causing trouble.—O.C.

Can you ANSWER these QUESTIONS

QUESTION K14—What is the time delay curve in seconds, for the different makes of time delay fuses, both renewable and non renewable fuses?—H.S.

QUESTION L14—Please advise us on the following practice. After removing the pole pieces from a d-c generator or motor for purposes of repair and overhaul, we do not paint the bottoms of the poles or those sections on the stator frame where the poles are secured. A minority of the men in our shop believe that no harmful change in characteristics will result from painting between the poles and frame. Others are firmly against the practice.—A.H.J.

QUESTION M14—I recently had an unusual bit of trouble with a small series motor. The motor would start and run satisfactorily for a period of time. But if stopped, it would not restart until it had cooled off. I finally traced the trouble to a poor solder connection. When the motor had run for a while, the connection actually came apart due to the elongation of the copper conductors. The current would jump the gap as long as the motor was going. But once the motor was stopped, the gap was sufficient to prevent any current from passing. However, when the motor had cooled sufficiently, contact was again made, and the motor started fine.—H.H.S.

QUESTION N14—I would like to know if any of your readers have any experience regarding the relative life of various cables buried directly in concrete? I am interested in using RW, TW, rubber with lead sheath, and this latter type with the addition of an overall braid.—C.S.

PLEASE SEND IN
YOUR ANSWERS BY MARCH 15

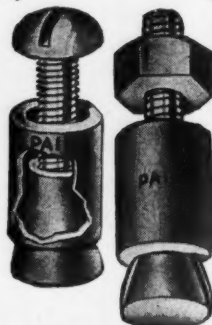


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"Saved 7 1/2 hours in one day with one bit. Go on new job tomorrow. Saved money—had easier going."

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KENNAMETAL Inc. LATROBE, PA.

CALLING SYSTEM LAYOUT

[FROM PAGE 81]

finally the central control pushbutton plate which is equipped with complete terminal strips for all wires or 44 conductors, 42 for the room stations and two for the transformer.

The terminals indicated above for the riser junction boxes allows for a few spares in most cases over and above those required for the conductors. It is recommended that all terminal strips have extra terminals.

The selection of the sizes of junction or pull boxes is based upon the number of conductors and the number of terminals to be used. Ample size over and above the size of the terminal strips should be allowed for ease in handling the conductors and lacing of same. Typical junction box data relative to this problem is shown. The number of wires between all points is shown in Fig. 2 and is based upon the wiring diagram in Fig. 1. The use of cable is recommended wherever possible because as a rule it is more economical to handle than loose wires and usually requires smaller conduits with the additional ease in pulling through conduit. In this instance individual conductors may be used on the floors and perhaps will be found just as economical. Cable will be found most satisfactory on the risers and therefore the sizes of conduits are based upon the use of same. The cable suggested is of the braided type composed of single No. 16 B & S gauge rubber covered conductors. In a small system of this type any size cables with No. 18 B & S gauge rubber covered wires would also be found satisfactory.

Color coded wires should be used throughout, as indicated on the Color Code Chart. As shown, the cables are made up with six wires having solid colors. Following this the wires have these same basic colors and may be further identified with one or more colored stripes known as "tracers".

All conductors should be provided with adhesive labels attached to the insulation of each wire near the point of attachment to the terminal on the strip. They may be secured with numerals and other identifying marks to correspond with those on the junction box charts.

The power supply suggested in this system is a transformer having a capacity of 50 volt-amperes with a primary winding of 115 volts 60 cycle or as required, and a secondary of 24 volts, properly fused for protection.



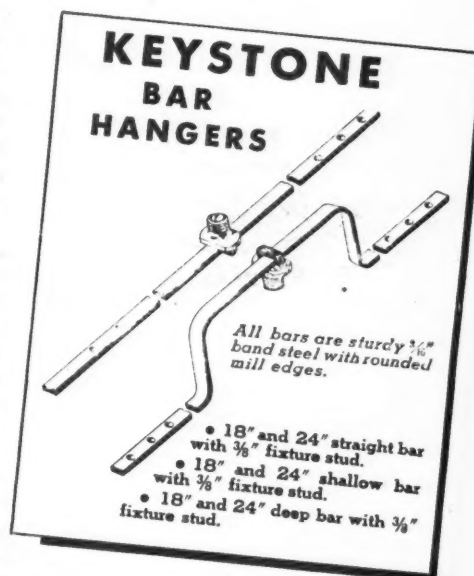
Immediate Delivery

Would you like to add to your profits and increase your sales? Look into this Keystone line of electrical equipment. Manufacturing economies bring you these electrical products at very attractive prices.

The Keystone Square Wireways come in 1 to 5 ft. lengths, with flanges at each end so sections can be easily and quickly clamped together. Available in 4" x 4" and 6" x 6" sizes. Hinged cover and ample knockouts facilitate wire installation.

Elbow and Pull Box (90°) is designed with new "smooth flow" corner, which eliminates many troublesome problems in threading wires through. Available in 4" x 4" and 6" x 6" sizes, with hinged cover and knockouts.

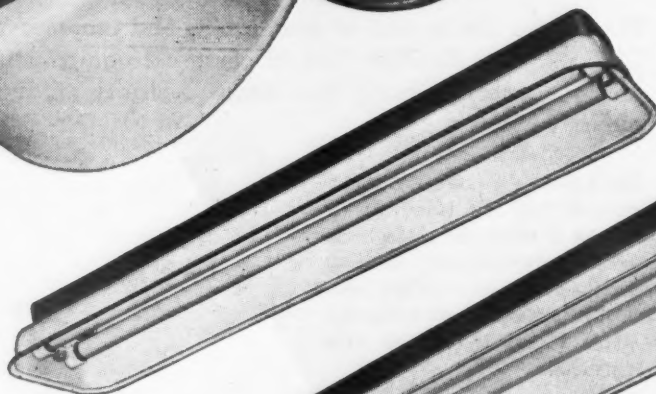
Closing Plates, Drop Hangers, Bracket Hangers, and Trough Collars—all available in sizes 4" and 6"—in standard black baked enamel to match Wireways and Elbows. (Furnished plated to meet coastal climatic conditions.)



Ask your wholesaler for Keystone and you will save money. Let us send you catalog sheets and price list.



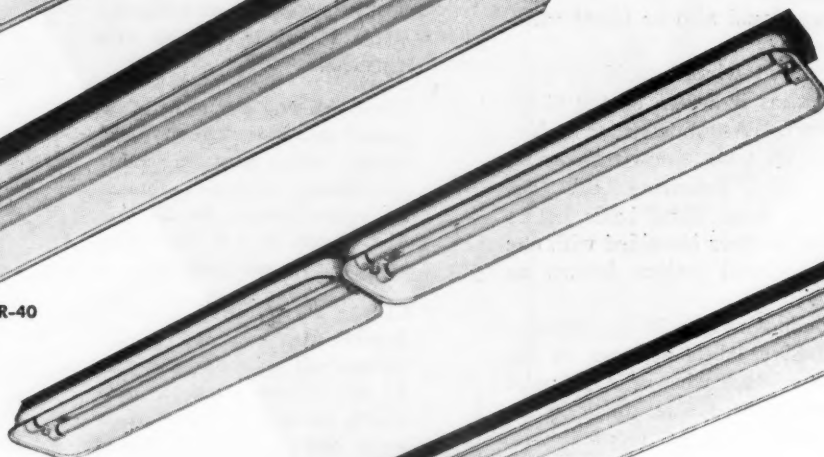
YOU CAN BE **SURE**.. IF IT'S
Westinghouse



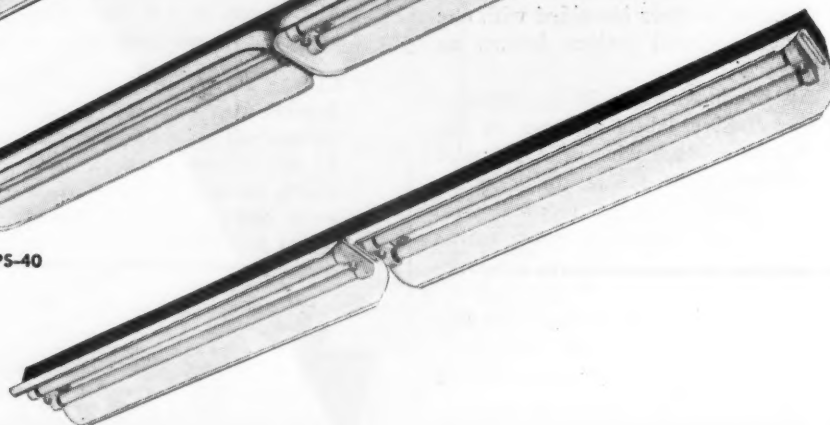
2 HP-40



2 HPR-40



4 HPS-40



4 HPC-40

ANOTHER *Reason to Buy* **WESTINGHOUSE INDUSTRIAL FIXTURES** **The Heavy Duty Lampholder**

Announcing . . . the new push-type, twin lamp holder that radically cuts maintenance costs . . . eliminates socket replacements. Available now in the Westinghouse fixtures shown at left . . . *and at no increase in fixture price.*

The new heavy-duty holder is designed to help you sell more fixtures and increase your profits on maintenance jobs. It cuts socket replacement by eliminating breakage and chipping. Lamps can be inserted quicker—easier, and they can't fall out. Starters are housed in the lamp holder—can be changed without removing lamps. Smooth, rounded, one-piece construction makes cleaning simple.

CUTS MAINTENANCE COSTS 6 WAYS

1. The all-steel housing provides indestructible protection for the lamp holder.
2. Spring-type socket at both ends of fixture makes lamp insertion quick and simple. Lamp is guided into position by a bevelled ring guide. Once inserted, the lamp can't fall out!

3. Spring pressure at both ends of the lamp provides a "floating ride" for the lamps—minimizing the effects of shock and vibration.

4. Starters are readily accessible and can be replaced without removing lamps. Arrow on socket housing indicates lamp operated by starter.

5. Sliding action of spring contacts provides self-cleaning contact with lamp pins. A safe, positive electrical contact is assured.

6. Lamp holder wiring contacts are so arranged that connections can be made without removing unit from the fixture.

Specify Westinghouse fixtures with the new heavy-duty lamp holders. Save yourself and your customers needless maintenance expense.

For further information about the new Westinghouse line of industrial luminaires featuring the heavy-duty lamp holder, write for booklet B-4194. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-04202



Westinghouse

PLANNED LIGHTING PAYS

K.O. to HEAT!



● The problem of destructive "heat", bane of safety switch *life*, has been solved in Cutler-Hammer's new line of safety switches. Now the switch mechanism is designed to withstand safely any degree of heat that can be expected from correctly selected fuses.

And this line has also been designed for greater ease of installation, convenience of operation, dependability and attractiveness. Cutler-Hammer wholesalers and alert contractors, from coast to coast, feature and recommend these *quality* safety switches. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.



Motor Shops

Sand Blast Booth Has Turntable Dolly

A sand blast booth with a cable-operated turntable dolly comprises the latest piece of shop equipment designed and built by Spaulding Electric Company of Detroit in its perpetual campaign to take drudgery out of motor repair operations. The blast unit is adjacent to the burn-out and stripping booth.

The Spaulding shop employs roller conveyors to simplify equipment handling and speed assembly work. Motors are placed on the conveyor at the rear of the shop, go through the disassembly, stripping and cleaning departments, then through the coil making and assembly sections to the dip tank and bake ovens. Previously, the conveyor went through the sand blast booth, but deterioration of the rollers due to the sand blast became a serious problem. Hence, the design of the new booth.

A booth enclosure is mounted $23\frac{1}{2}$ inches above the floor. It is 51 inches high, 51 inches wide and $44\frac{1}{2}$ inches long; is constructed of a 2-inch angle-iron frame with a $\frac{3}{16}$ -inch sheet steel facing; is lined with special $\frac{1}{4}$ -inch thick rubber sheeting; has a hopper underneath from which the sand is drawn for the blasting operation. One end of the booth is permanently sealed; the other end has two hinged doors of similar construction and equipped with deflecting strips to keep sand from blowing out through the bottom of the doors. Leakage at the rails is prevented by a cut-out shield that fits over the tracks and is inserted between the booth frame and closed doors.

The operator's side of the booth is equipped with two 8-inch diameter hand holes with tapered leather sleeves or boots; a $5\frac{1}{2}$ -inch by 9-inch vertical center opening for the chilled cast-iron spray nozzle; and a 31-inch by 11-inch rectangular viewing window equipped with heavy safety glass on the outside and an angular deflecting screen of fine brass mesh on the inside. Two 100-watt dust-tight lighting fixtures illuminate the booth interior.

Fine silicon-carbide "sand" (requested by Insurance companies to minimize danger of silicosis) is piped into the booth hopper from a storage container on the floor above. The sand is drawn from the bottom of the hopper

by compressed air at 125 lbs. per sq. in. pressure and forced through the spray nozzle. Extremely fine sand particles are drawn out through the booth vent hood; larger particles that can be re-used fall back into the hopper.

Two "rails" of 5 by 1.750 by .190 channel iron, with the top flange cut to

$1\frac{1}{4}$ -inch width, bridge the gap between the stripping booth conveyor and the sand blast unit. A specially designed dolly, attached to an endless steel cable operated by a hand crank, carries the motors from the stripping conveyor into the sand blast booth. The dolly turntable is level with the top of the

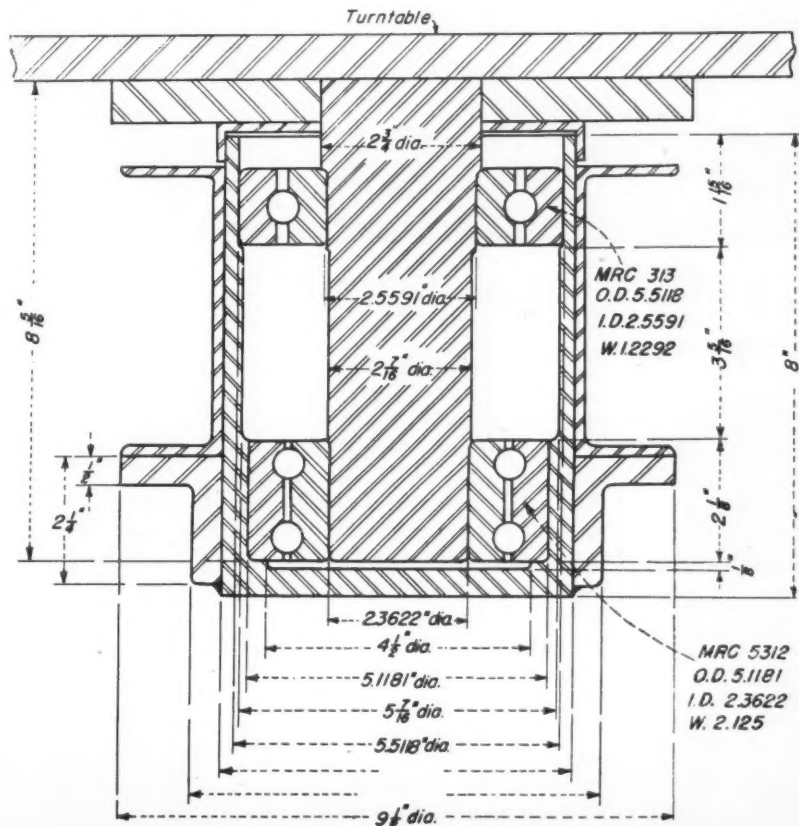


FIG. 1—Design details of ball bearing collar for dolly turntable.



Closeup of dolly showing attachment to endless cable and sealed enclosures for flanged-wheel and turntable ball bearing assemblies.

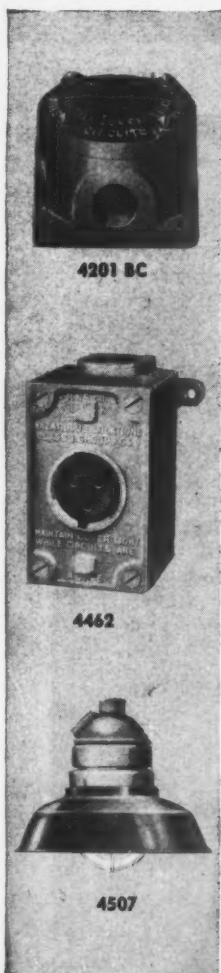
RUSSELL & STOLL

"BUY-WORDS" THAT ECLIPSE THEM ALL

Explosion Proof

a Combination Known Everywhere

EXPLOSION-PROOF FIXTURES AND FITTINGS



Say "RUSSELL & STOLL" and you think of "EXPLOSION-PROOF"...a combination known throughout the industry. Sell RUSSELL & STOLL Explosion-Proof Fixtures and Fittings and you sell customer confidence because of their high standard quality and long life of dependable service.

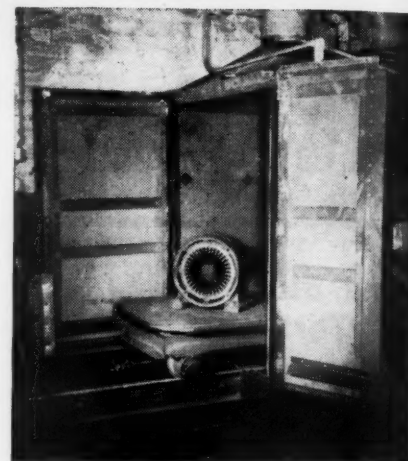
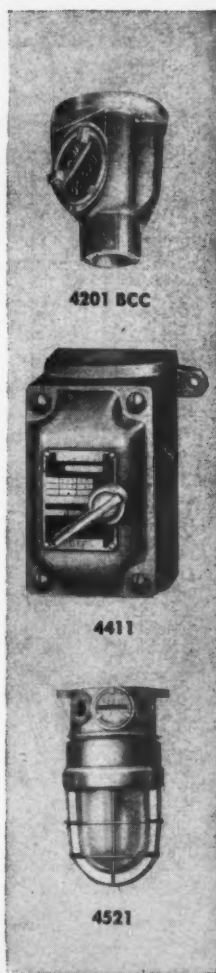
RUSSELL & STOLL Fixtures and Fittings, for all outdoor and hazardous areas, are precision-built to withstand the toughest service conditions . . . whether meeting the abuse of extreme climatic conditions, vapors, dust, or explosive gases.

The well-known RUSSELL & STOLL EVER-LOK wiring devices prevent accidental interruption for the life of the job. All units afford a high degree of interchangeability, and are designed for easy installation and wiring.

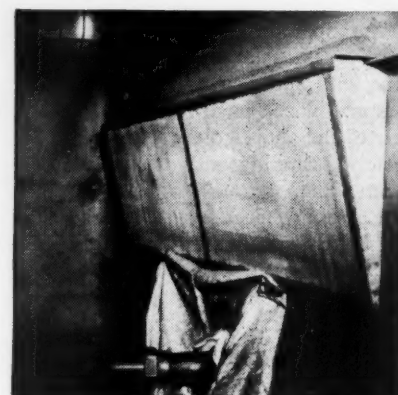
A descriptive and illustrated broadside No. 101-5 gives pertinent information. Write for your copy.

Sold Through Electrical Wholesalers

SALES OFFICES
IN PRINCIPAL CITIES



Turntable dolly carries stators into sand blast booth at Spaulding Electric Company. Booth is adjacent to stripping booth conveyor at left.



Angular screen of fine brass mesh on booth interior deflects sand particles from viewing window.

conveyor rolls so stators can be rolled onto the dolly without any lifting.

The dolly is 30 inches long; 31½ inches wide; and about 9½ inches high from rail to top of turntable. A heavy steel base made of 2x3-inch angle and 5-in. channel cross pieces is mounted to four 5-inch diameter flanged wheels. The wheels are fixed on angles which turn in Hoover No. 305 ball bearings encased in G. E. sealed housings.

Two 32-inch square sections of boiler plate constitute the turntable. The permanent layer of ¾-inch plate is capped by a removable "blast plate" of ¾-in. steel held by four bolts accessible from the under side of the turntable. The four corners are cut and rounded to permit rotation inside the sand blast booth.

A ball bearing collar assembly in a sealed housing permits turntable rotation (see diagram). Two Marlan-Rockwell ball bearings are used; the top one is the centering bearing, the bottom one the thrust bearing. The sealed housings protect all bearings from the sand spray.

Motors up to 50 hp., 1200 rpm., or 100 hp., 3600 rpm., can be cleaned in this sand blast booth.

RUSSELL & STOLL COMPANY, INC.

Precision-Built Electrical Equipment

125 BARCLAY STREET, NEW YORK 7, N. Y.



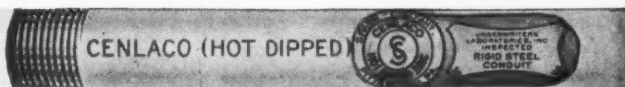
Although we are producing immense quantities of Central Rigid Steel Conduit, there just isn't enough to meet today's tremendous demand for it. Consequently, there may be times when your distributor will be unable to fill your complete order immediately.

But to make his limited supply go a long way, your Central Rigid Steel Conduit Distributor often makes partial deliveries. That's his way of making sure that you get a fair share of his supply.

Keep in touch with your Central Rigid Steel Conduit distributor. You will find him a dependable source for all kinds of electrical supplies.

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CENTLACO a hot dipped galvanized and lacquered finish, inside and out.



CENTRAL WHITE electro-galvanized outside and black enameled inside.



CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.



PANTHER and DRAGON tapes
MUST pass these tests to
assure *SPLICES*
THAT STAY PUT!

- ✓ Breaking Strength
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 Friction and Rubber Tapes pass these tests by ample margins — your proof of tapes that will stay put, last longer. So for tapes that are tops, always ask for PANTHER and DRAGON. They are sold only through recognized independent wholesalers. The Okonite Company, Passaic, New Jersey.



Panther and Dragon
 friction and rubber tapes

6694

Clutch Type Tension Device

Some type of wire tension device must be used in every coil winding department. Many shops use friction blocks which bear directly on the wire insulation. If rigidly set, these blocks do not allow for variations in wire diameter or insulation thickness. They frequently damage wire insulation and may provide uneven tension. Some shops find that friction blocks require too much time to set up, adjust and dress the blocks when they become grooved.

All of these difficulties are eliminated by a clutch type wire tension device designed and fabricated by LeRoy E. Whitaker of the Electrical Installation Company, Cambridge, Mass. As an entry in the 1948 NISA Awards Contest, it won honorable mention. Publication of details are possible through the courtesy of the 1948 Awards Committee of the National Industrial Service Association.

The device operates on the principle

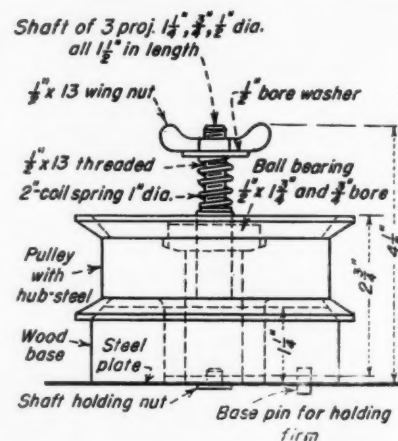


FIG. 1—Clutch type tension device assembly showing all component parts of the unit; also pertinent dimensions.

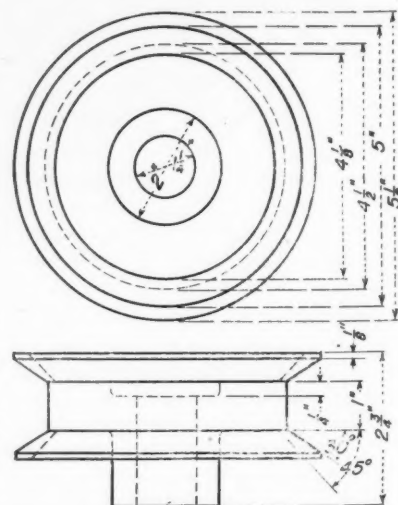


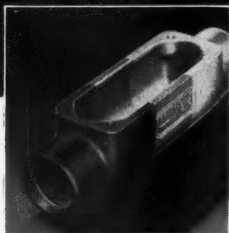
FIG. 2—Construction details of the rotating sheave or capstan around which the magnet wire is wrapped.



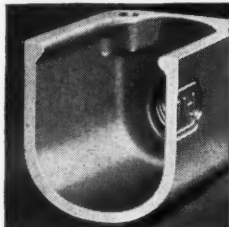
standardize on...

PYLETS

PYLET PRACTICAL DESIGN FEATURES



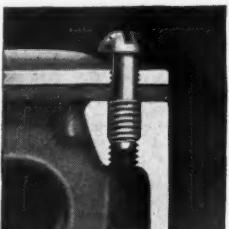
Accurate, malleable iron castings made in Pyle-National's own foundry. Double weather-proof protection—first, galvanized, and then finished with baked sprayed aluminum.



Smooth interiors, round edges and large wiring spaces prevent damage to wires. Ribbed sidewalls provide extra strength.



Strong Domed Covers are warped and Body Cover Joints are ground flat for tight gasket seal. Heavy hub sections of ample cross section are tapped straight and true with accurate, cleancut, **TAPERED** threads.



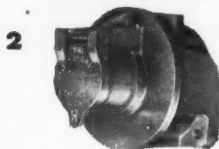
Dowl-pin type self retaining screws provide easy alignment of covers—hold cover and gasket together during handling.

A Modern Line of Improved Heavy-Duty Conduit Fittings

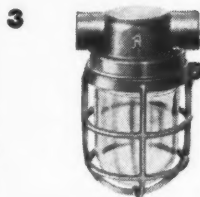
A Full Range of Types and Sizes for Industrial Wiring



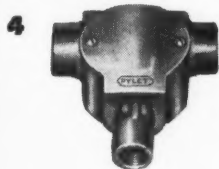
1. FS AND FD PYLETS AND COVERS—1, 2, 3 and 4 gang, square corner types, take all standard switch and receptacle plates.



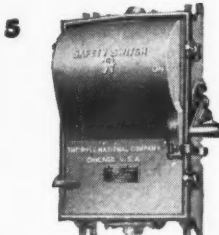
2. ROUND BASE PYLETS AND COVERS—Ideal for Vapor-tight junction boxes—Flush and surface mounting. Take standard 4-inch outlet box cover; also vaportight fixtures, plug receptacles and Flexible fixture hangers.



3. VAPORTIGHT LIGHTING FIXTURES—With heavy cast metal bases, weathertight sealing and sturdy guards. Complete line, for 10 to 200 watt lamps, for conduit or wall mounting, universal 4 and 5 hub types, two and three gang, handrail and outlet box types, also midjet fixtures.



4. FLEXIBLE FIXTURE HANGER PYLETS—Universal joint hub allows easy removal of fixture, free swing movement of fixture with stop to prevent wire injury, also cushion type for protection against vibration. Also rectangular Pylets with suspension hanger.



5. CAST METAL SAFETY SWITCHES AND CIRCUIT BREAKER PYLETS—Heavy duty safety switches and fuse boxes with or without plug receptacles and circuit breaker Pylets with all features for reliable service under severe conditions. Safety switches have quick make and break, interlocked cover and weathertight gaskets on both cover and hub plates. Available with interlocking plug receptacles.

Refer to your Pylet Catalog 1100 for complete listings including plugs and receptacles—explosion-proof pylets, cord and cable grips—flexible conduit couplings—unions—reducers—elbows and grip handles—portable hand lamps.

THE PYLE-NATIONAL COMPANY

1344 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

DISTRICT OFFICES and REPRESENTATIVES in Principal Cities of the United States
EXPORT DEPARTMENT: International Railway Supply Co., 30 Church St., New York
CANADIAN AGENT: The Holden Co., Ltd., Montreal



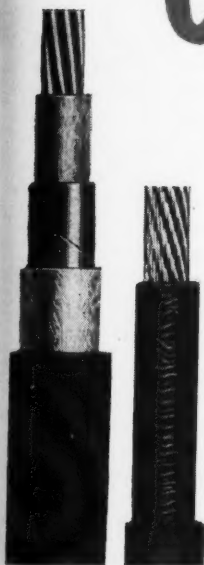
PLUGS and RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • LOCOMOTIVE HEADLIGHTS • MULTI-VENT AIR DISTRIBUTION

Heat...Moisture...Fumes and Dirt



that ruin ordinary electrical cable
prove the stamina of

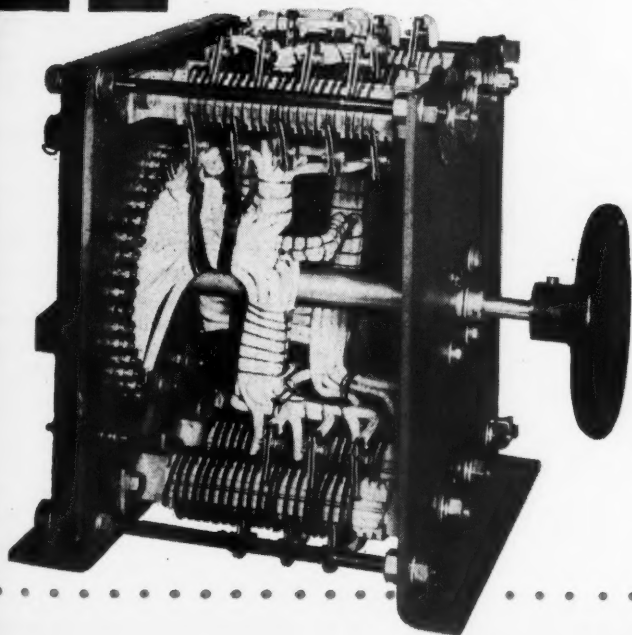
U·S·S Amerbestos



Amerbestos AVC Wire and Cable. Resists heat, flame, moisture, oil, grease and corrosive fumes. Has high dielectric strength, will not ravel or unwind, can be stripped easily. Copper conductor, Felted asbestos, Varnished cambric, Asbestos braid.

Amerbestos All-Asbestos Construction. For open wiring subjected to extreme heat, oil, grease or corrosive fumes. Available in smokeless white or with MFH moisture resistant compound. Tinned flexible copper conductor, felted asbestos insulation, asbestos braid.

Amerbestos Smokeless Wiring in a rheostat. Resistance to heat aging makes Amerbestos a good choice for switchboards, control panels and heating equipment.



Wherever electrical cable may be exposed to continuous heat, heat and moisture, oil, grease, corrosive fumes or fire hazard, U·S·S Amerbestos is a safe choice.

Use it around furnaces and ovens, in boiler rooms and steel mills, for forced draft blowers and ash pit drives and for general hot-spot wiring.

FOR HIGH DIELECTRIC STRENGTH AND MOISTURE RESISTANCE U·S·S Amerbestos AVC is highly recommended. The varnished cambric insulation located between two layers of asbestos felting gives much better protection against moisture. For this reason AVC cables should be used in conduit where condensation is a problem or for open wiring where excessive moisture, steam or high humidity are encountered.

FOR HIGHEST HEAT RESISTANCE IN DRY LOCATIONS the all-asbestos construction is preferred. This cable is designed for open wiring and can be operated at higher temperatures than the AVC type. Where moisture resistance is desired, the cable is impregnated with (MFH) compound.

Asbestos cable is still "king" among heat-resisting cables. No other type assures such long life, freedom from cracking and general all-around good service as U·S·S Amerbestos. Write for our booklet, Amerbestos Wires and Cables, which gives complete engineering data.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM,
SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



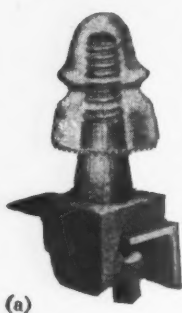
Amerbestos Wire and Cable

UNITED STATES STEEL

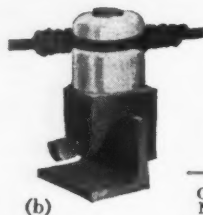


When lines are to be run along steel girders, under roofs or where cramped quarters will not permit nailing up insulators, Steel City Universal Insulator Supports—probably better described as “Beam Clamps”—solve the problem at a saving of time and insure a safer and neater job.

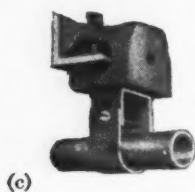
Here are a few typical applications . . .



(a) 503 Support with No. 615 Wood Pin and Double-Groove, Double Petticoat Glass insulator.



(b) 502 Support with No. 3 1/2 Insulator.



(c) 501 Support with No. 616 Pipe Hanger.



(d) 502 Support with No. 2 B & D Cleat mounted on No. 512 Cleat Attachment.

| Cat. No. | Description | Size | Jaw Opening |
|----------|---|--------|-------------|
| 500 | Standard tapping 1/4-20. . . . | 1" | 3/4" |
| 509 | Standard tapping 10-24. . . . | 1" | 3/4" |
| 501 | Standard tapping 3/8-18. . . . | 1 1/2" | 3/4" |
| 502 | Standard tapping 3/8-16. . . . | 2" | 7/8" |
| 503 | Standard tapping 1/2-13. . . . | 2 1/2" | 7/8" |
| 505 | Long base. Standard tapping 10-24 and 3/8" clearance. . . . | 1 1/2" | 3/4" |
| 506 | Long base. Standard tapping 10-24 and 1/2-13. . . . | 2" | 1" |
| 507 | Standard tapping 1/2-13. . . . | 2 1/2" | 1 1/4" |
| 508 | Standard tapping 1/2-13. . . . | 2 1/2" | 2" |

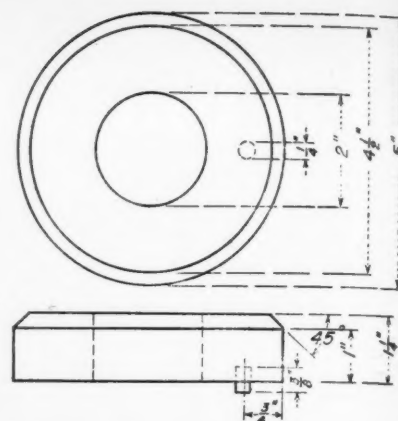


FIG. 3—Construction details of the stationary hard maple friction block with its beveled bearing surface.

of a capstan with an internal brake. Two or three turns of wire are wrapped around the capstan block and the tension is regulated by a wing nut bearing on a loading spring which rides on a ball bearing. It has been used with as many as five wires in hand with perfect results.

Simple construction, assembly and operation are features of the unit. Standard material items found in most shops, are used to make the various parts listed below:

- 1—A steel mounting plate with a hole for a base positioning pin.
- 2—A 4 1/2-inch cold rolled steel shaft with three 1 1/2-inch long bearing surfaces.
- 3—A capstan constructed from a double-groove V-belt pulley with a 4 1/2-inch groove diameter. The center spacer was turned off leaving one large groove with a 1-inch wide flat base.
- 4—A 5-inch diameter hard maple disc (1 1/4-inch thick at center) with a 45-degree bevel turned on one edge to fit the capstan. A metal pin inserted in the bottom of the block fits the hole in the steel base plate.
5. A pressure assembly consisting of a 2-inch long coil spring, wing nut, washers and ball bearing.

The device functions as follows: Two or three turns of magnet wire are wrapped around the capstan block and the wing nut is adjusted for proper tension. The wire takes a firm grip on the surface of the sheave groove. While the wire is being fed to the coil winder, the sheave rotates and tension can be adjusted as needed by merely tightening the wing nut on the loading spring shaft. This forces the tapered inner side of the rotating sheave against the stationary hard maple friction block. Result: A definite uniform tension on the magnet wire without scarring or damaging the insulation in any way.

STEEL CITY ELECTRIC CO.

OUTLET BOXES AND COVERS SWITCH AND FLOOR BOXES

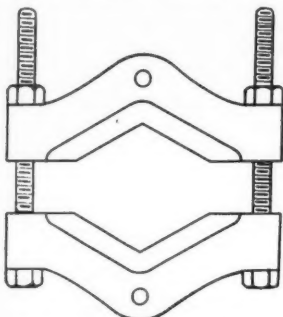
JUNCTION BOXES, CONDUIT FITTINGS AND ELECTRICAL SPECIALTIES

COLUMBUS AVE., PITTSBURGH 12, PA.

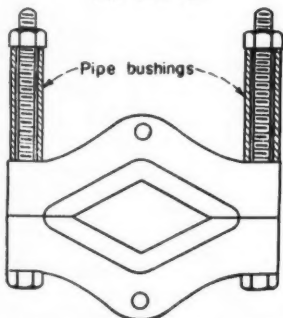
Pipe Bushings Speed Puller Adjustments

Removal of V-pulleys from motor shafts frequently presents a problem in motor service shops. Because of their apparent "light" construction, rough treatment definitely heads the "do not" precautionary list.

The fractional horsepower repair department of the Boustead Electric & Manufacturing Company, Minneapolis, Minn., uses an Owatonna sheave puller attachment that is adjustable from 2-inch to 6-inch sheaves. Adjustment is made by chasing the nuts of the two $\frac{1}{2}$ by 20 assembly bolts. Normally,



Puller attachment without pipe bushings



Attachment with pipe bushings in place

Pipe bushings on assembly bolts cut nut-running time when adjusting sheave puller attachment for small pulleys. Time savings of 85 per cent have been reported by Minneapolis shop.

it takes about 40 seconds to set the attachment on smaller pulleys—even when the bolt threads are free from grit and the nuts spin freely.

Boustead mechanic H. S. Milen cut this time to approximately six seconds, about an 85 percent saving in time per pulley. He simply inserted slit pipe bushings over the bolts between attachment collar and adjusting nuts. Each bushing consists of a 3-inch length of $\frac{1}{2}$ -inch conduit with a $\frac{9}{16}$ -inch wide longitudinal segment cut out to permit attachment or removal without taking off the adjustment nuts.

Entered in the 1948 NISA Award Contest, this shop idea is published through the courtesy of the 1948 NISA Award Contest Committee.



TEMFLEX 105 flexible plastic tubing

Identify it by the name strip

High heat stops most plastic tubings, but not TEMFLEX 105 — TEMFLEX 105 defies heat . . . works continuously at extreme temperatures . . . as high as 105° C!

And TEMFLEX 105 retains the remarkable properties you have found in former Irvington plastic tubings — right up through those top temperatures.

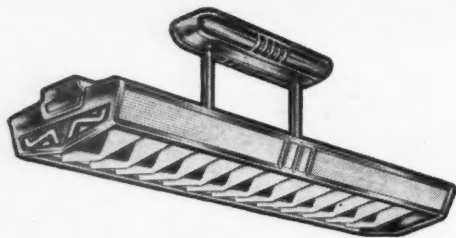
TEMFLEX 105 passed Underwriters' Laboratories tests, yes — and more. In our own laboratories, we ran further gruelling tests — demanding unusual flexibility, high dielectric strength and strong oil resistance . . . after aging longer, at temperatures higher, than U.L. requirements.

Try TEMFLEX 105 for yourself where "hot spots" in your equipment have given you trouble. A special name strip running the length of the tubing distinguishes TEMFLEX 105 from tubings limited to lower temperatures.

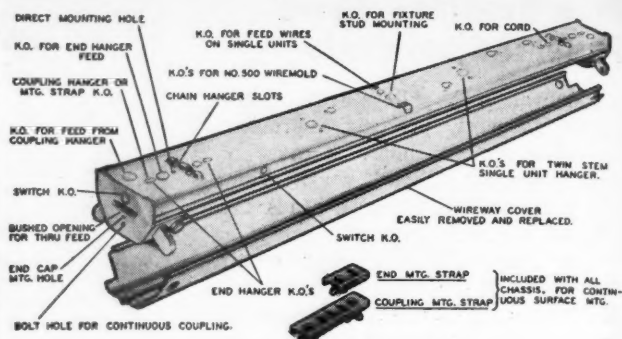
Generous samples and full data are yours for the asking. Send for them.

IRVINGTON

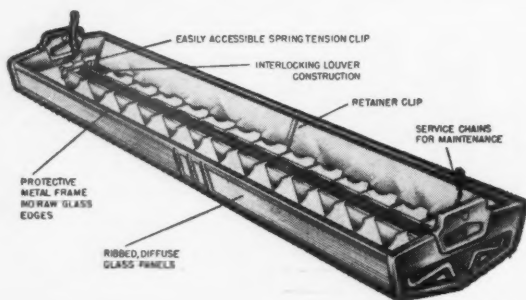
VARNISH & INSULATOR COMPANY
Irvington 11, New Jersey



**The Day-Brite "Viz-Aid"...
profitable choice because
it's quick and easy
to install**



Unusual installation and maintenance features are built into this basic chassis. Of sturdy die-formed and welded steel construction, this chassis is always uniform—aligns properly for continuous installations. The many knockouts (designed to make any and every type of installation easy) are typical of superior Day-Brite engineering.



Day-Brite's "Viz-Aid" fixtures have snap-on enclosures, easily installed without the use of tools. Service chains support the enclosure when it is released from the chassis for cleaning. Fixtures can be relamped without disturbing the enclosure.

"A-J" Adjustable Hangers have a swivel fitting and over one inch vertical adjustment to assure easy alignment of continuous runs after the installation has been completed.



More than 20,000 "Viz-Aids" are being installed in 80 Denver Public Schools

The Denver, Colorado Public School relighting program is attracting nationwide attention. Fixtures were selected by arranging *actual test installations by competing manufacturers*. With

impartial advice from experts, the Denver Board of Education judged the competitive installations, and *the fixture selected unanimously was the Day-Brite "Viz-Aid."*

No matter what type of installation it is, choose Day-Brite—the fixture with **built-in profits** for you.

IT'S EASY TO SEE WHEN IT'S

DAY-BRITE
Lighting



Day-Brite Lighting, Inc.,
5402 Bulwer Avenue,
St. Louis 7, Missouri.
In Canada: Amalgamated
Electric Corp., Ltd.,
Toronto 6, Ontario.

Day-Brite fluorescent fixtures are engineered for every seeing task. Distributed nationally by leading electrical suppliers.

Modern Lighting

50 Footcandles For Banking Institution

The Norfolk County Trust Company, Brookline, Massachusetts, believes that alertness, accuracy and personnel morale are definitely improved by surroundings which are spacious, restful and properly illuminated. This is evidenced by the lighting plan that is installed in private offices, directors' room, accounting section and bookkeeping department. Designed by Ray Beale in the architectural offices of J. William Beale and Son, Boston, in conjunction with C. A. Russell of the Boston Edison commercial lighting division, the installation utilizes fluorescent sources in a variety of treatments for both general and functional illumination.

As installed by electrical contractor A. J. Wolfe, the plan delivers an average of 50 footcandles at working levels, with various areas ranging from 44 to 56.5 footcandles.

Featured in the directors' room is a false skylight of ribbed glass, behind which, on two-foot centers, two-lamp 40-watt white lamps are mounted in RLM industrial reflectors. Fixtures are suspended 18 inches above the glass paneling so that lamp image is unnoticeable and the entire area is evenly illuminated with diffuse light. Between this main central skylight

and each of the four walls, two Holoflux 3-lamp units are installed end-to-end, directing concentrated light downwards toward wall surfaces. The atmosphere of comfort and dignity is maintained through the tasteful use of murals, natural wood paneling, acous-

tical tiled ceiling treatments, carpeting and leather upholstered chairs. Average light meter readings are 51 footcandles.

The private office of the executive vice president also employs Holoflux recessed fixtures to provide an aver-



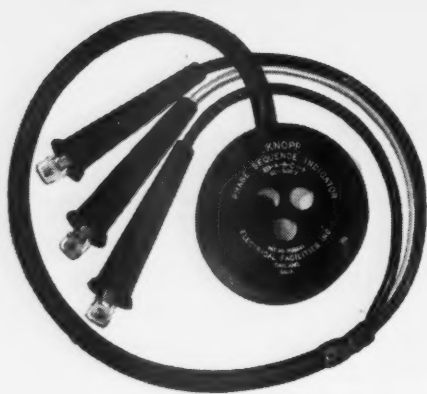
Private office of executive vice president has average of 56.5 footcandles at desk level, produced by four 3-lamp Holoflux units set flush in ceiling.



False skylight, backed by RLM industrial two-lamp fixtures on two-foot centers, provides high-level general illumination in directors' room of Norfolk County Trust Company, while Holoflux recessed units direct concentrated light to wall murals.



Bookkeeping department, with surface mounted end-to-end ribbed glass units providing illumination, achieved better than 49 footcandles on desks.



To be Sure of Proper 3-Phase Connections, get the Reliable KNOPP Phase Sequence Indicator

- *Nothing to Adjust—
Positive Readings*
- *Used for 20 years
the nation over*

All over the U. S. men-in-the-know prefer the Knopp Phase Sequence Indicator. It saves time.

Just clip it on, push the safety button and determine beyond a doubt whether the phase sequence is A-B-C; or C-B-A. This positive Knopp Phase Sequence Indicator has nothing for you to change or adjust for readings. No misleading lamps or dials. It does protect equipment and assure properly connected poly-phase wiring; 50 to 500 volts, 3 phase, 3 wire, 25-60 cycles.

Well-Built, Foolproof

It stands up under rough field use and gives accurate and reliable service. It is made by Electrical Facilities Inc., technical electric equipment manufacturers of 21 years experience. This indicator has a laminated bakelite housing and no exposed metal parts. It is built for complete safety. Fully insulated clips can remain attached between tests as safety push button permits indication only when needed. Weighing but 21 oz., the Knopp Phase Sequence Indicator is small and easy to carry. Price \$25; with leather carrying case, \$30. Order today or write for complete description.

ELECTRICAL FACILITIES INC.

4232 Holden St.

Oakland 8, Calif.



Three-tone painted wall treatments, acoustical ceilings and asphalt-tiled floors create pleasant atmosphere, while recessed Holoflux units and air conditioning maintains healthful conditions for personnel.

age of 56.5 footcandles at desk level. Fixtures are mounted singly in an open square arrangement, each unit containing three 40-watt lamps. As in the directors' room, wall paneling, drapes, carpeting and dignified furnishings contribute to the environment productive of concentration.

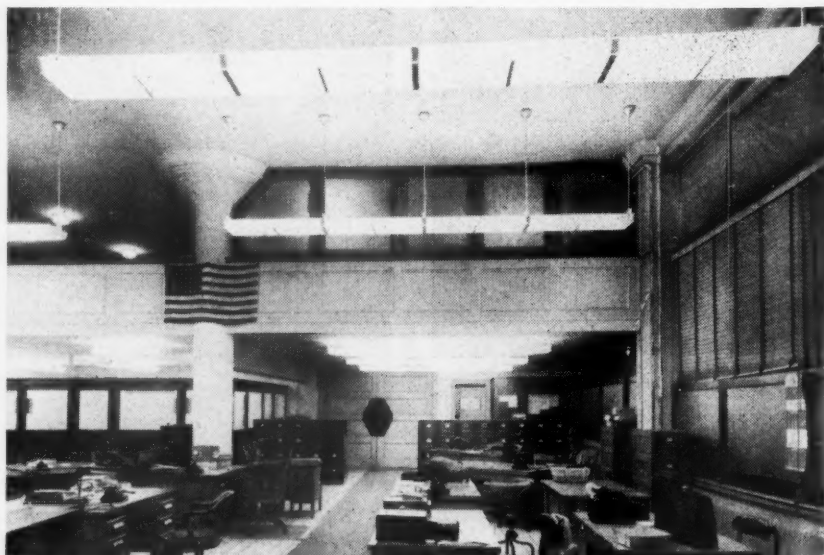
Using both recessed and surface-mounted ribbed glass units, three-tone

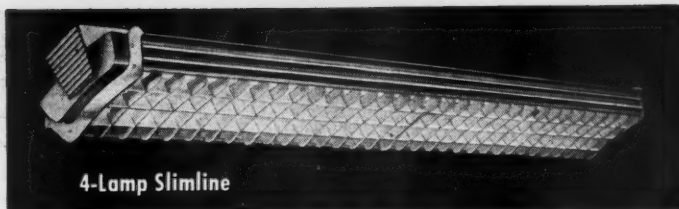
painted wall treatments, sound-absorbing ceilings and asphalt tiled floors, the bookkeeping department averages 49 footcandles of illumination while the accounting section achieves levels of 44 footcandles. With shadows and glare minimized, these air-conditioned areas are productive of maximum efficiency with peak worker comfort.

Special Reflector For Deep Suspension

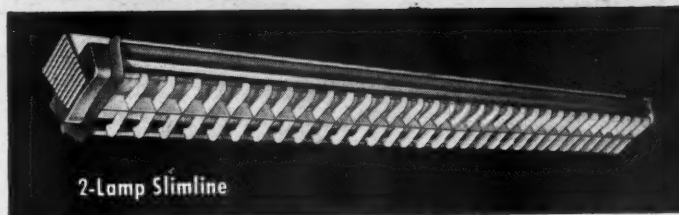
A high-bay office area can be illuminated with pleasing results when the lighting plan is similar to that of the B. F. Goodrich Company, Boston, Mass. Due to unusually deep suspension of fixtures, a special reflector was designed by Westinghouse so that the distribution of light is 15 percent upwards to relieve ceiling shadows, while the remainder of light is directed downwards towards desk areas. In the entire area, 91 LU-160 units were installed, each fixture mounting

four 40-watt fluorescent lamps. Beneath balconies, the same fixture was surface mounted. This slight variation in mounting height and erection resulted in a variance in lighting intensities on working planes, the levels ranging from 52 to 72 footcandles with an over-all average of 60. The layout, pictured below, was designed by Lee Steffenhagen, lighting engineer for Westinghouse, in collaboration with C. A. Russell, lighting consultant of the Boston Edison Company.





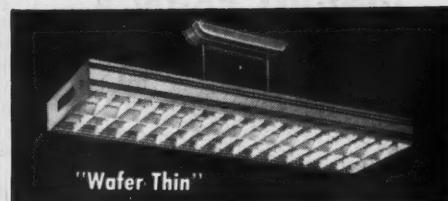
4-Lamp Slimline



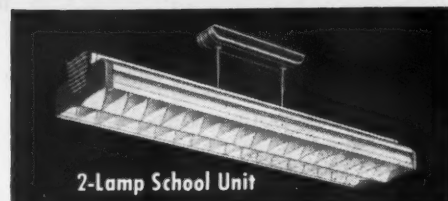
2-Lamp Slimline



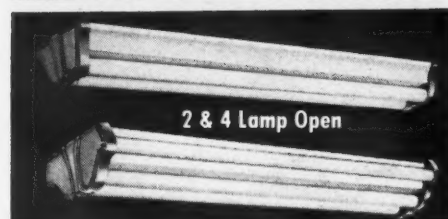
Troffer System



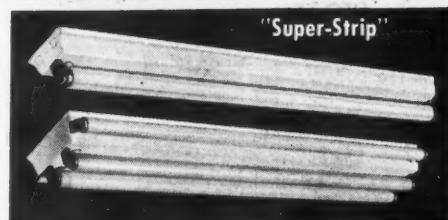
"Wafer Thin"



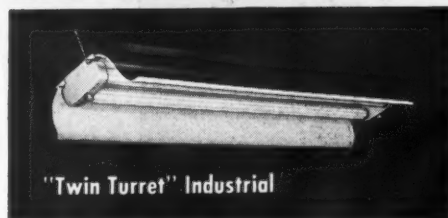
2-Lamp School Unit



2 & 4 Lamp Open



"Super-Strip"



"Twin Turret" Industrial



Spot-Rays



Spotlights



"Zoomlights"



Typewriter Desk Lamp



"Lullaby"
Bedlamp Radio



Sun &
Heat Lamps

NOW OVER 150 MODELS

in the **MITCHELL** **COMPLETE LIGHTING LINE!**

Build your lighting business profitably around the *one complete line* that covers your entire market. The MITCHELL Line—now well over the 150-model mark—is the most complete and diversified in the industry. This progressive development of "in demand" preferred quality merchandise, priced for profitable volume sales, gives you a powerful selling "edge." Here are your MITCHELL merchandising advantages:

1. Everything you need from one source
2. An ever-growing line that helps you grow
3. Strong acceptance in the lighting field
4. High saleability — competitive price
— Guaranteed standards of quality

It's good business to concentrate your selling program around MITCHELL—the *complete lighting line* that builds solid business and bigger sales for you.

YOU'LL SELL THEM ALL

WRITE FOR FULL CATALOG AND DETAILS

MITCHELL

Mitchell Manufacturing Company

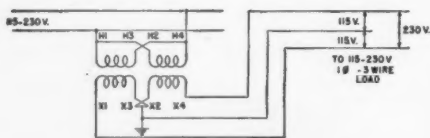
2525 CLYBOURN AVENUE, CHICAGO 14, ILLINOIS

In Canada: Mitchell Manufacturing Company, Ltd., Toronto, Canada

First Choice in Lighting • The Pioneer Line that Keeps Growing

HOW TO PROVIDE A 3 WIRE 115/230 VOLT CIRCUIT FROM A 2-WIRE PRIMARY

No need to rewire a job when you need a 3-wire 115/230 volt circuit. Simply connect an Acme Electric air cooled power transformer to the 2-wire primary at the most convenient location and you're all set for 3-wire 115/230 volt service.



Acme Electric air cooled transformers are available for immediate delivery in capacities from 1/10 KVA to 50 KVA in all standard primary voltage ratings up to 2400 volts. Write for Bulletin.

ACME ELECTRIC CORP.

362 Water St. Cuba, New York

Manufacturers of Transformers for Fluorescent lighting, radio and television, neon signs, electronic devices and rectifiers.



Intensities ranging from 100- to 70-footcandles are measured after 600 hours of use beneath lighting bays which include eggcrate fluorescent four-lamp 40-watt units and 150-watt PAR-38 floodlamps, both surface-mounted on a 10-foot ceiling.

Surface Mounting For Maximum Ceiling Height

To maintain maximum ceiling heights in the merchandising areas of Street's, Inc., Tulsa, Okla., surface mounting of both incandescent and fluorescent lighting fixtures was recommended by lighting designer A. de'Espenza of the Lawson Electric Company. By following this recommendation, the 10-foot ceiling elevation was not lessened and the lighting plan became a functional combination of general and accent illuminating units. In designing the plan, Mr. de'Espenza considered the structural beam pattern and specified that units be installed in series of bays to conform with this existing condition. Units selected were Guth Hy-Liters and Eggcrate Aristolites. Incandes-

cent units are equipped with 150-watt PAR-38 lamps, while fluorescent fixtures are four-lamp 40-watt assemblies. After 600 hours of service, meter readings indicated averages of 100 footcandles directly beneath fixtures, 90 footcandles in the center of the lighting bays, and 70 footcandles beneath structural beams. With this high-level illumination, color values and textures can be readily judged by shoppers, a feature which is greatly appreciated by Street's customers. Bearing columns are encased in glass to create an impression of space, and walls are attractively decorated with a large-figured paper. Wall cases and service counters are top-lighted by fluorescent coves.

Tickets for Lighting Show

ADMISSION to the 3rd International Lighting Exposition at the Stevens Hotel, Chicago March 29 through April 1 is by ticket only. For yours, send in the following coupon and your tickets will be forwarded promptly. There is no charge.

The Editor
Electrical Construction and Maintenance
330 W. 42nd Street
New York 18, N. Y.

I want.....tickets for the 3rd International Lighting Exposition to be held in Chicago March 29 to April 1.

Name Title

Company

Address

City & State.....



Why I always use **CERTIFIED BALLASTS** in fixtures I make!

- As a fixture manufacturer, I must have assurance that my complete fixture will be dependable and trouble-free in operation. I can't afford to offer a fixture that doesn't protect wholesalers and contractors and assure greatest satisfaction to the user.

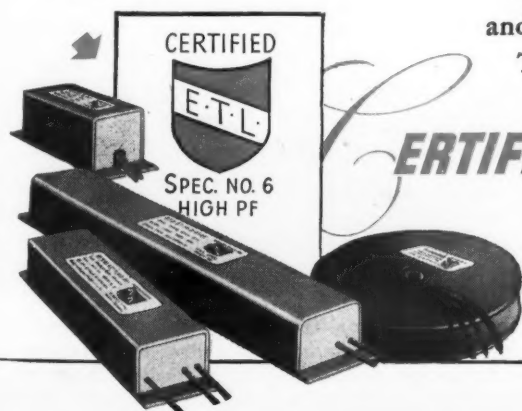
My reputation . . . my business future depend on the performance of the fixtures I make. That's why I always use Certified Ballasts.

Certified Ballasts assure—

- Full lamp life
- Rated light output
- Quiet operation
- Reliable performance

Certified Ballasts are made to rigid specifications—then tested and checked by impartial Electrical Testing Laboratories, Inc.

That's why I have confidence in Certified Ballasts. You will, too.



CERTIFIED BALLAST MANUFACTURERS

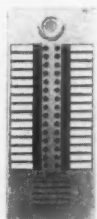
Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO

Telephones? Mail Boxes?

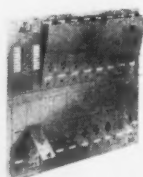
... one of these Couch
Systems will dove-tail
with your specifications

When plans call for mail boxes and inter-suite 'phone systems, look to Couch for equipment to fill the bill. If you don't find the type you want illustrated below, a Couch representative will gladly assist you.



Vestibule
Telephones

Type 74C—
Cordless type il-
lustrated is the
most popular unit . . . no protruding
attachments . . . easily installed.



Tilting Mailboxes

Type 73—Post Office
approved mail boxes for use with Vesti-
bule Telephone. Features include frame
separate from boxes for easy installa-
tion and tenant doors which can be set
in open position for easy removal of
mail.



Suite Telephones

Type 47—Cordless suite phones make
a neat installation and can be provided
to give a variety of service. Type 52,
with the handset type instrument, pro-
vides greater convenience for particular
installations.

S. H. COUCH CO., Inc.

DEPT. 42, NO. QUINCY 71, MASSACHUSETTS

Private telephones for HOME and OFFICE . . .
hospital signaling systems apartment house tele-
phones and mailboxes . . . fire alarm systems for
industrial plants and public buildings.

Lighting Aids Automotive Sales

Studebaker cars are presented to potential automobile buyers in Brookline, Massachusetts, in a setting which is as modern as the products on display, for Moloney Motors Incorporated has illuminated their showrooms in accordance with accepted standards of planned lighting. Designed and executed by the Joseph Bennett Company, architects and general contractors of Boston, the display space combines direct and indirect lighting to furnish general diffuse illumination for the entire area, and highlighted settings for cars and accessories.

A dropped ceiling of acoustical tile provides space for a pattern of recessed 150-watt R-40 floodlamps, shielded by circular louvers, and also lends interest to the sales space by enclosing several cove-lighting installations consisting of double rows of Slimline fluorescent lamps.

Directly above the large show windows, series of Holophane units, mounting 200-watt incandescent lamps behind concentrating lenses, are installed in continuous rows to build up footcandle intensities on the flanks of exhibited automobiles.

Accessories for the new cars are displayed in wall cases which are top-lighted by four-lamp 40-watt industrial fluorescent units mounted continuously above the upper natural-wood border. In an adjacent section, where repair parts are sold, neon tubing is used to call customers' attention to the proper counter, while two-lamp louvred units, recessed flush with the dropped ceiling in this area, illuminate the sales counter.

Completing the impression of modern progressiveness, floors are of terazzo, walls are rough acoustical plaster.

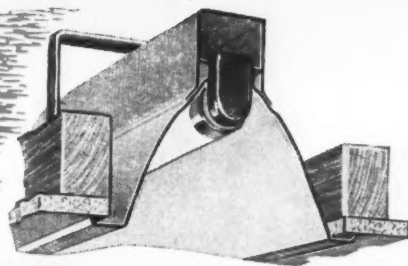


Dropped ceiling in the showrooms of Moloney Motors, Brookline, Massachusetts, provides space for recessed louvred downlights and two-row Slimline cove installation.



Accessories are displayed in wall cases, top-lighted by continuous installation of four-lamp 40-watt white fluorescent industrial units. Parts are sold at counter illuminated by flush recessed two-lamp fixtures located above and behind lettered sign of neon tubing.

WHEN YOU TALK ABOUT
PLANNED LIGHTING . . .
TALK ABOUT . . .



Curtis

EYE-COMFORT

TROFFERS



FIRST NATIONAL BANK
Chicago, Ill.

Illustrated above is a partial view of one of the many departments in the First National Bank of Chicago, showing its installation of A B C Lighting. Approximately five miles of Curtis "Eye-Comfort" Troffers have been installed, providing seventy footcandles of glareless illumination on the working plane.

Curtis "Eye-Comfort" Alzak Aluminum Troffers . . . easily installed and maintained . . . utilize the new 40 watt, T-17, 60-inch low-brightness lamp. The reflector contour approximates a parabola and is designed to direct a maximum amount of light to the working plane but limits the amount delivered to the eye . . . true A B C Lighting.

Appropriate Brightness Control, the big feature in modern lighting. The Key? . . . the luminaire . . . the CHARACTERISTICS? . . . high light utilization with low unit brightness. PLUS the relationship of the chromatic values of room contents. Write Curtis for further details . . . for easier sales.



CURTIS LIGHTING, INC.

6135 WEST 65th STREET, CHICAGO 38, ILLINOIS
CHICAGO . . TORONTO . . NEW YORK



SLIMLINE LAMPS

Available IN QUANTITY for the first time!

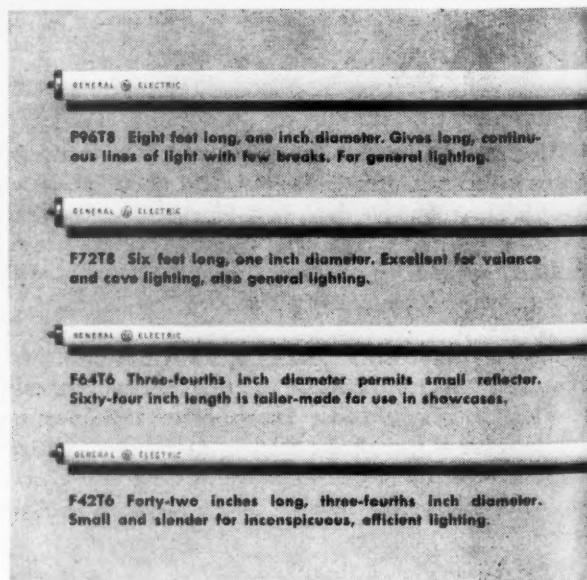


Amazing new G-E slimlines offer you new lamp business ... new fixture business ... wide application.

Here's the biggest news in fluorescent since General Electric developed the first practical fluorescent lamp over 10 years ago! General Electric slimline fluorescent lamps—world's most advanced source of light—are now available in quantity!

Think of the customers for slimline lighting—stores, offices, factories, schools, restaurants, theaters, showrooms, bowling alleys! Just think of the new business—people you've never sold before—you can get with this great new product!

Slimline lamp sales give you an excellent profit. Sales of new improved fixtures made especially for G-E slimlines will add to your profits, too. For more data on G-E slimline production, price, application and promotion, contact your General Electric lamp office today!



LATEST ACHIEVEMENT OF THE G-E LAMP RESEARCH THAT HAS

ARE HERE!

*Now you can CASH IN on G-E's
development of the slimline lamp!*

EIGHT BIG NEW SELLING ADVANTAGES

1. MODERN, STREAMLINED APPEARANCE. General Electric slimlines — up to eight feet in length — provide long, continuous lines of light for unique architectural effects.

2. INSTANT START. No starters are used. Just flick the switch for sure, instant starting. Special ballast provides necessary starting voltage.

3. HIGHER EFFICIENCY. Slimlines are the most efficient fluorescent lamps made.

4. EASIER TO INSTALL AND MAINTAIN. Single pin base fits new push-pull type socket. One man can easily install and replace.

5. SIMPLIFIED WIRING. Elimination of starter simplifies wiring, reduces maintenance.

6. THREE BRIGHTNESS LEVELS with one lamp. Operate G-E slimlines at 100, 200, or 300 milliamperes by changing ballasts only.

7. BETTER LIGHT CONTROL. Small diameters permit use of smaller reflector to give better direction of light.

8. LONG LIFE. Although the last published rated life was from 2500 to 6000 hours (depending on frequency of "on" and "off") many users are reporting considerably longer life.

G. E.'s powerful advertising campaign breaks the good news to your customers

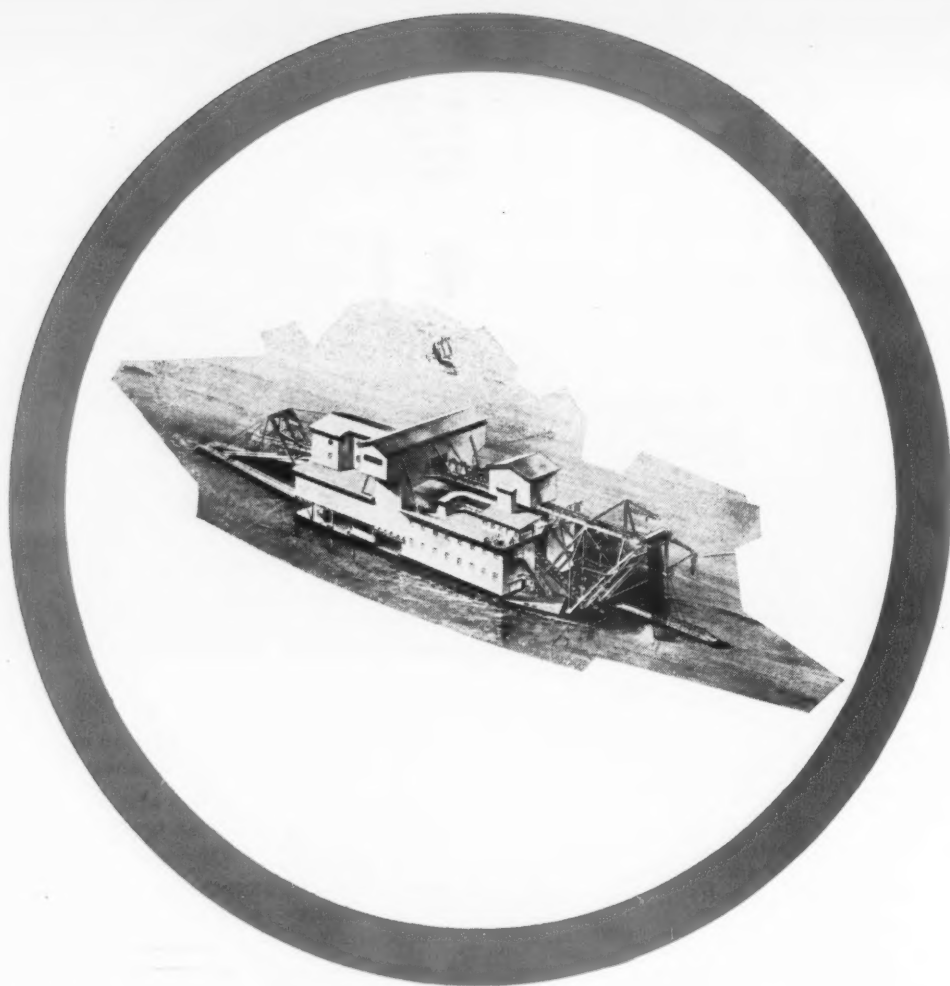
News about G-E slimlines is getting big, nationwide coverage with spreads in Time, Newsweek and Business Week, followed by more hard-hitting ads, all reaching *your* customers. Look for these ads (Post, February 19; Time, February 21 and March 21; Business Week, February 12 and March 12)! They mean more slimline sales for you!

Call your General Electric lamp office today and get set for G-E slimline fluorescent lamp business.



G-E LAMPS
GENERAL  **ELECTRIC**

PIONEERED ALMOST EVERY MAJOR DEVELOPMENT IN FLUORESCENT



Simplex Anhydrex-insulated cables are doing another big job; this time, out in the Dutch East Indies. As the life lines of electric power and control circuits on board the huge tin-mining dredges, Stuyvesant and Roosevelt, they're playing an important part in stepping up war-ravaged tin production for the world.

Out there, where supply is limited, productive dredging lays down a stiff demand: Original equipment must assure years of unfailing service! ANHYDREX cables fill that bill on this job, and they will meet many of your wiring needs with the same reliable performance. Here's why:

Anhydrex insulation is a special compound that combines low water absorption with sound electrical and physical properties. It is unexcelled for electrical and mechanical stability when exposed to water and moisture. It has high dielectric strength, low power factor and low dielectric constant. It resists sun-checking and has long life. It can be used where copper temperatures run as high as 75°C. up to 8000 volts, and as high as 70°C. at more than 8000 volts.

Cables insulated with Anhydrex can be protected by a neoprene jacket, a wire armor or metallic tape, a neoprene jacket combined with wire armor or metallic tape, or by a treated braid. They are made to meet a wide variety of applications in underground, aerial, or duct installations. You'll find them especially dependable in street, airport, park, and industrial lighting circuits; in telephone, signal and control systems; and as underground service entrance cables.

Simplex _____
WIRES & CABLES
SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

Answered by
F. N. M. SQUIRES
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.

and **GLEN ROWELL**
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

Questions on the Code

Farm Wiring

Q. I have wired a few farms where separate buildings were used as laundry rooms. In each case they were small affairs and I have served them with two No. 10 or two No. 12 conductors depending upon the distance between them and the dwelling. In each I have used a single circuit fused at 15 amperes to supply both the light outlet and the outlet for the washing machine. The other day a new inspector turned down one of these jobs saying the outlet for the washing machine would have to be on an appliance circuit of No. 12 wire fused at 20 amperes. Is this required by the Code?—M.C.E.

A. No, the N. E. Code would not require the use of an appliance circuit in such a building as Section 2115b pertains only to dwelling occupancies and a separate building on a farm used as a wash house can hardly be considered as a dwelling. If a single 15 ampere circuit is capable of supplying the required number of outlets, there is nothing in the Code which would make it necessary to provide two circuits. However, the Code does not intend to assure an adequate installation, and it is very possible the average wash house might easily utilize two circuits, one for lights and one for convenience outlets especially where a mangle or clothes drier might be used.—G.R.

Disconnect Switch

Q. Does the Code require the use of a dust-tight switch cabinet for a disconnect switch used on a motor circuit in a grain elevator? We are installing a 100 hp. 440 volt three phase motor and find that we can make quite a saving if we can use an ordinary switch for this purpose.—A.N.S.

A. The N. E. Code under Section 5056-a2 gives permission to use an ordinary switch as an isolating or disconnecting switch in a Class 2

Division 1 location provided such switch is equipped with a tight-fitting cover and it contains no openings through which sparks or burning material might escape. Such switches are not to contain fuses nor are they to be used to interrupt current. Inasmuch as all ordinary switch cabinets contain holes for attachment screws or bolts, etc., care must be taken to effectively close all openings. Even though the switch used is rated in horsepower, it would be a good idea to mark such a switch "Do not open under load". This is not required by the Code; however, if you are using a general use type switch as permitted by Section 4402-c for motors of more than 50 horsepower, the Code does recommend that the switch be so marked.—G.R.

Wires in Conduit

Q. How do you figure the difference in conduit fill for a new job and a rewire job?

For instance, Table 4 of the 1947 code gives number of conductors in conduit or tubing with type R or T wire.

On a rewire job using type T wire, I have been allowing contractors to use one size larger wire. For instance, 3 No. 8 type R in $\frac{3}{4}$ in. conduit they would be permitted to pull out the 3 No. 8 and install 3 No. 6 type T wire. Is this correct?—L.R.T.

A. To figure the number and size of wires which may be placed in an existing conduit, Tables 11, 13 and 19 should be used. It would not always be safe to use the method of one size larger wire than is shown in Table 4.

The combined area of the conductors as shown in Table 13 should not exceed the percentage of cross-sectional area of the conduit as shown in Table 11. (Table 12 shows some of these values and is quite handy in making these calculations.) As for the particular job mentioned: 3 No. 6 Type T. = $3 \times .0819 \text{ sq. in.} = .2457$
50% (for "rewiring") of $\frac{3}{4}$ " Conduit = 50% of .53 sq. in. = .265

As the combined cross sectional area of the 3 No. 6 type T wires is smaller than 50 percent of the cross sectional area of the $\frac{3}{4}$ in. conduit, this combination would be acceptable, provided that the structural conditions of the building make it impractical to install larger conduit and greater carrying capacity is needed for increased load.

This latter part of the preceding paragraph is not always clearly understood as mention of it appears in the 1947 Code only in the third line of the table in Table 11. In the 1940 Code it was carried in the text of paragraph 3005 e.

If the conduit is embedded for practically its entire length in concrete, it is considered impractical to remove it and install larger conduit. If, however, it only passes through concrete floors and then it is exposed, it is not impractical and the rule of 50 percent fill would not apply.—F.N.M.S.

Conductors

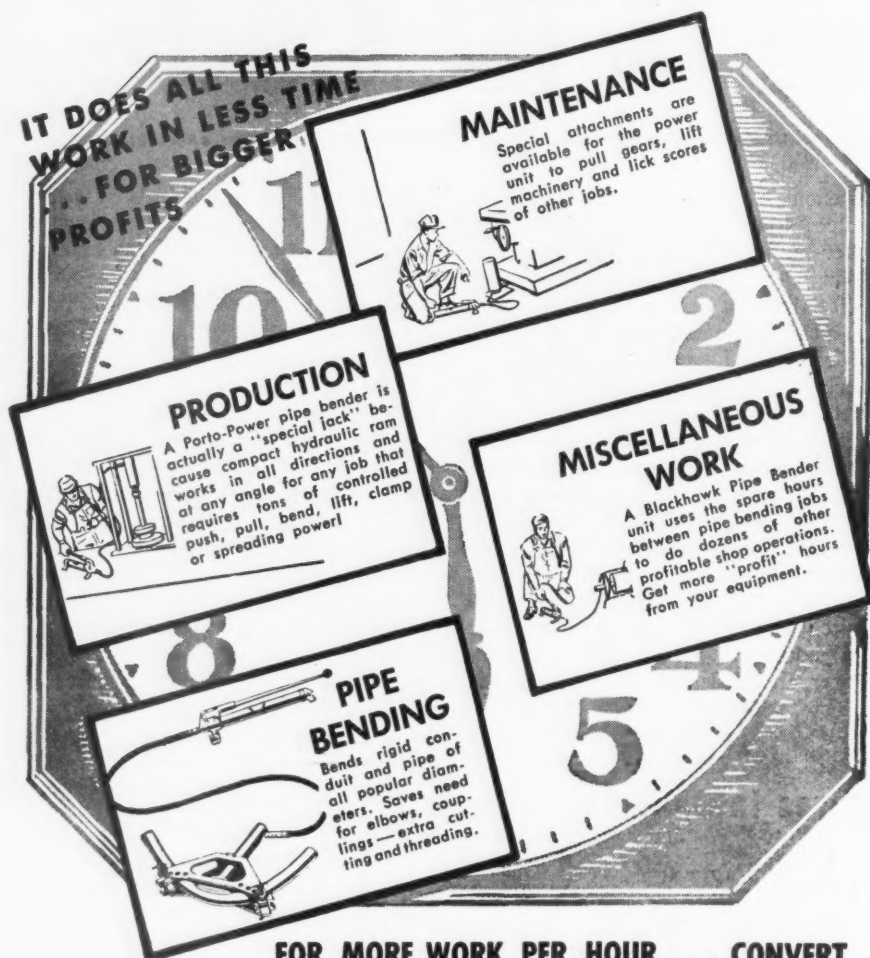
Q. On a fair size housing project which we plan to wire, the Specifications call for underground feeders between the houses and garages. If we use ordinary USE conductors buried directly in the earth, are there any special precautions that should be taken?—B.K.

A. The N. E. Code under Section 2311 permits the use of such conductors when buried directly in the ground but as yet the Code does not contain much in the way of installation methods. Section 2312 provides for protection on poles and Section 2313 covers entrance to buildings. Experience has indicated the need for additional Code requirements, and to assure a satisfactory installation, the following precautions should also be taken.

1. Cables of other than the armored type should be buried sufficiently deep so they will not be injured by normal aboveground operations, such as spading or plowing, making it necessary to bury the cable from 14 to 18 inches.

2. Cables passing under unpaved

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driveways should be given additional mechanical protection. The use of a creosoted plank placed over the cable is usually considered adequate.

3. Where laid in soil containing stones or gravel, a layer of sand or finely divided earth at least two inches in thickness should be used both under and over the cable.

4. Where passing through the wall of a building supported on below frost foundation, a loop, consisting of several inches of free cable, should be so placed that the heaving action of the earth cannot shear the cable at the point of entry. Similar caution should also be followed where cables are brought down poles in conduits.

If these suggestions are complied with, the use of the new low cost type USE cables and single conductors will provide a trouble free method of bringing electrical energy into buildings, especially in those areas subject to heavy loading and in addition will improve appearances.—G.R.

A-C Circuits

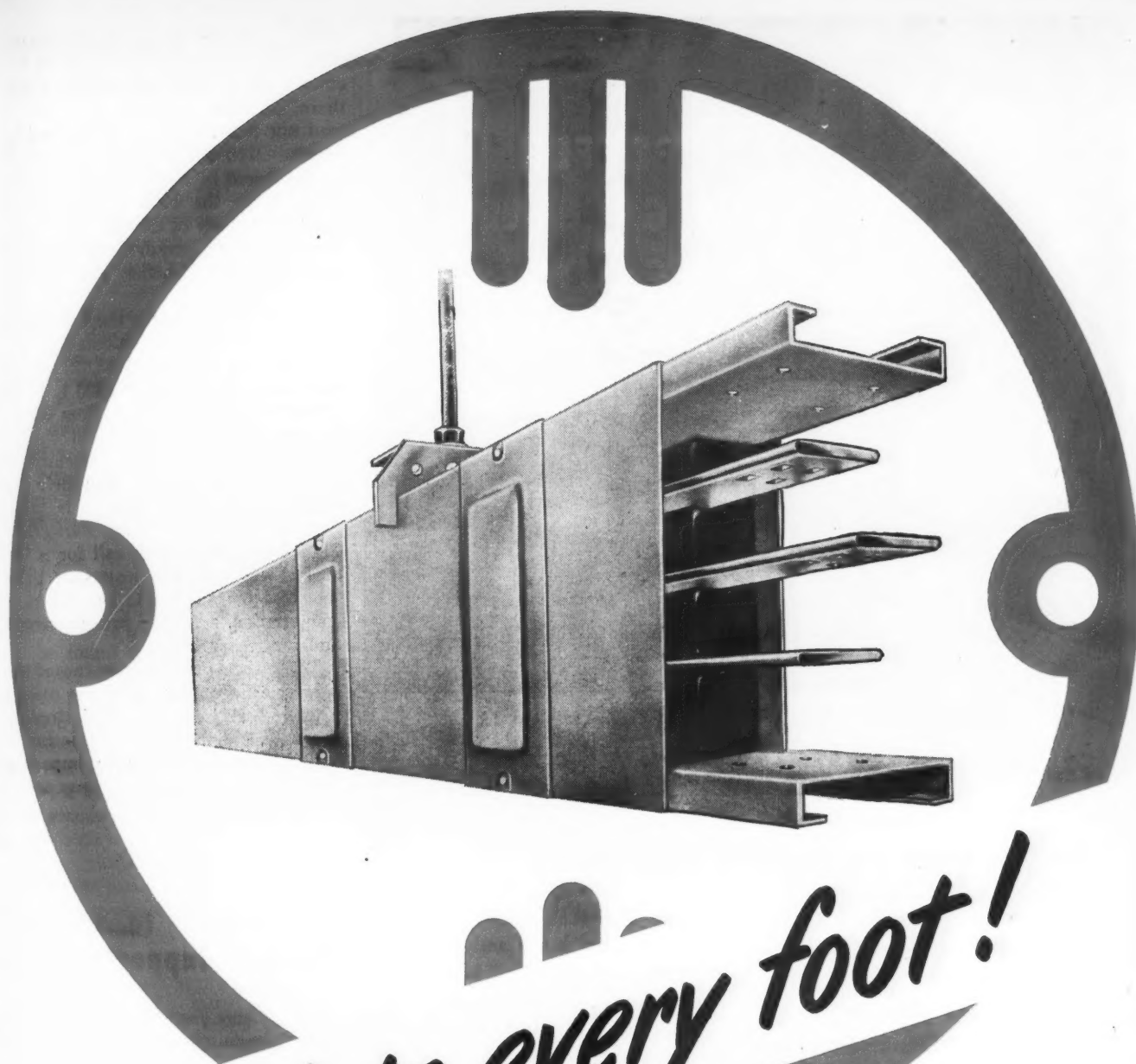
Q. On a power job I am working on, one of the cabinets was entered from the back by three No. 2/0 conductors through three separately bushed openings. To reduce current loss, I spaced these holes equal distances apart in triangular positions and yet the inspector tells me that the Code does not permit the conductors to pass through the separate openings. What does the Code say about this?—J.I.M.

A. Section 3018 of the N. E. Code contains the answer to your question. Alternating current circuits operating at more than 50 amperes must be so arranged where they enter a metal enclosure to avoid overheating the metal by induction. In your case you might comply with the Code by cutting slots through the metal between the three bushed openings.—G.R.

Circuits for Show Windows

Q. "Article 220—Feeders". 3203b clearly calls for 200 watts per linear foot of glass in show windows. This paragraph applies to feeders only. Where in the Code is the demand made that this capacity must be applied to breaker panels and also that circuit capacity must be run to the windows, regardless whether there is a present use for them or not?—H.W.H.

A. The requirement for the number of branch circuits to be in-



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at bolted connections are silverplated.

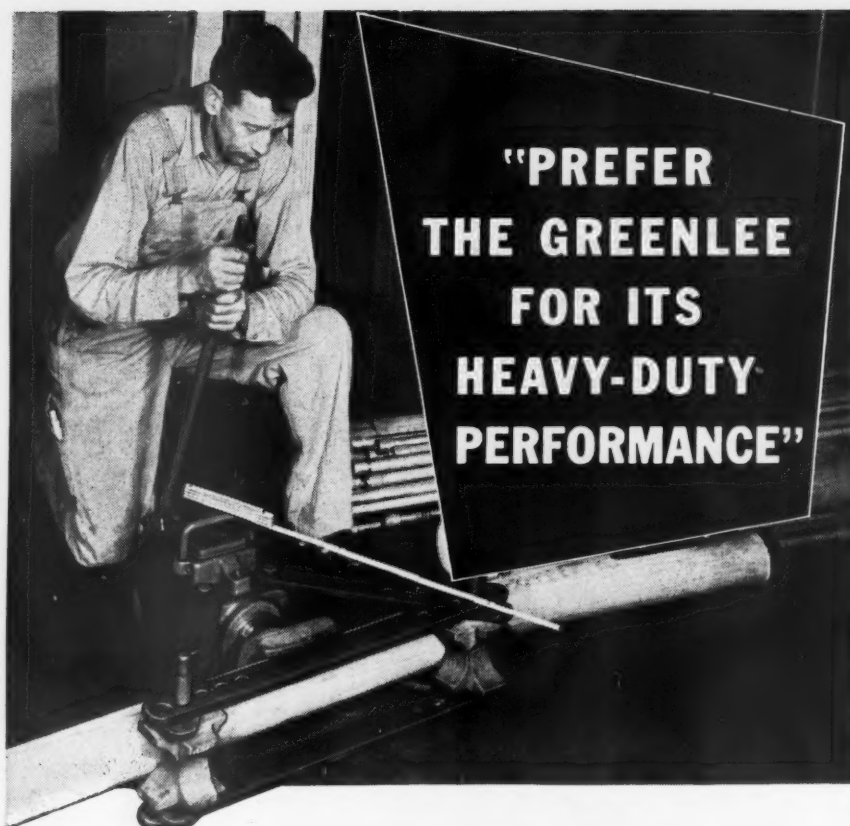
See your Federal Distributor about Federal Noark Bus Duct. And write us for your copy of Bulletin 180 giving full descriptions and data. Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.



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With a GREENLEE *one man* in but a few minutes makes smooth, precise bends in rigid and *thin-wall* conduit, pipe up to 4½", tubing, bus-bars. It's a compact, portable unit—lets you make bends *right on the job*. Quickly pays for itself. Write today for free Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1742 Columbia Avenue, Rockford, Illinois, U. S. A.



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stalled will be found in Paragraph 2115. This first states that branch circuits shall be installed and then that there shall be provided a computed load not less than that determined by Section 2116 and that the number of circuits shall be not less than that determined by the total computed load and the capacity of circuits to be used. This therefore, requires the installation of circuits whether they will be used or not.

Article 2116 governs the calculation of the load and in that calculation, uses the table in Section 2203. The fact that the table in Section 2203 is in the article concerning feeders, does not invalidate the requirements in Section 2115. Of course, if the circuits are required to be installed, then their protective devices must also be installed.

It will be noted that Paragraphs 2116c2 and 2203b both call for a load of not less than 200 watts per linear foot of show window to be used in the computation both for branch circuits and for feeder loads.

These requirements have caused considerable arguments as every once in a while such loads are not desired nor are used and the requirements for the installation of the circuits impose an economic loss. However, these are the requirements.—F.N.M.S.

Spacing of Conduit Supports

Q. I have just refused to accept a conduit job because of improper support of the conduit. On a long run of 2-inch pipe the supports were about 30 feet apart and it is my contention that supports should be not more than ten feet apart. Now there does not appear to be any backing in the Code to support me should this case come up in court. Do you know of any Code section to which I can refer?—S.M.

A. All the N. E. Code contains will be found under Sections 1105 and 3004, and neither section provides for maximum spacing of conduit supports. Section 1105 states that raceways shall be carefully secured in place and attached to fittings, and Section 3004 contains a similar ruling. It therefore becomes necessary for the electrical inspector to determine whether or not the conduit is properly secured in place. I personally will agree with you that in most installations the supports should not be more than ten feet apart. Many engineers require even closer spacing of conduit supports when preparing specifications.—G.R.

Transformer For Lamps

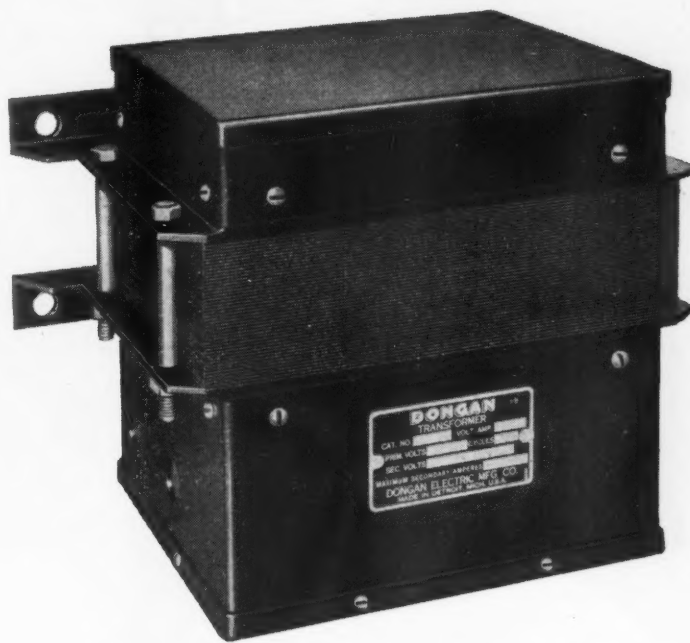
Q. We are manufacturing a surface grinding machine which will be operated by a 5 hp. 3 phase 440 volt motor, and we also plan to supply 220 volt motors as an alternate power supply. This machine will have two lamps attached to it, and we would like to tap two of the phase conductors between the junction box on the machine and the motor controller and insert a small transformer to supply the lamps. One of our engineers has expressed some doubt about this as he says it would not be permitted by the Code. Can you advise us of the Code ruling covering this procedure which we are considering?—K.G.

A. The N. E. Code requires that such lamps be served by a grounded circuit operating at not more than 150 volts to ground. This ruling will be found under Section 6704 of the Code. Therefore it will not be possible to tap two phase wires to supply the transformer, instead, provisions for a fourth conductor must be provided and the transformer may then be connected between the neutral and one of the phase conductors.—G. R.

Fluorescent Fixtures

Q. Does the Code really prohibit placing 9 four 40 watt fluorescent fixtures on a 15 ampere circuit? According to my figures, the total connected load would then amount to only 1440 watts which does not overload a 15 ampere circuit.—C.C.

A. You have neglected to consider the ballast load as directed by Section 2125b, which reads as follows: "The total load shall not exceed the branch circuit rating. In computing the load of lighting units which employ ballasts, transformers or auto-transformers, the load shall be based on the total of the ampere rating of such units and not on the wattage of the lamps." Then if the fixtures are hung in a store building or any other place where in normal operation all fixtures on the circuit are likely to be used for long periods of time, it becomes necessary to comply with Section 2116, which will limit you to 8 outlets on a 15 ampere circuit and a total loading of 12 amperes. Therefore it is evident that 9 four lamp fluorescent fixtures cannot be supplied by a single 15 ampere circuit.—G.R.



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A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.



METHODS FROM A LONDON SHOP

[FROM PAGE 87]

Unless the work has to wait for customer's acceptance of our estimate the Form is then stamped "PROCEED" and it is sent with the motor to Fitters Bench. Here any parts for rewind are removed and sent to the Preparation Shop, and other parts are cleaned and overhauled as necessary. They are then stowed away in a labelled box to await the part which is being rewound. The Fitter enters his report on form in Section D.

The Preparation Shop is set apart for stripping out old windings, cleaning laminations, taking data of windings and winding new coils. Most of this work is carried out by Junior labor. The Data of the old windings is entered on a "Data Card", which is placed in a celophane envelope to keep it clean, and sent to the Winding Shop with the part to be rewound and the new coils.

The Winding shop prepares the slot insulation, inserts the coils, connects up and tests for resistance, connections and insulation to frame.

In each shop a brief report is entered in Section E of form and name of man who carries out the work is also noted.

If tests are satisfactory the parts are then sent to Dipping and Baking Dept. For small machines we use infra-red drying, but larger machines are put into an electrically heated oven equipped with thermostat and time switch. The oven has a hinged top operated by counterweights which allow heavy stators or armatures to be lowered into position by overhead tackle on a runway.

All the parts are then returned to Fitters Bench where they are assembled and section F on form is completed.

The next stage is testing. Tester will study the reports of the work done on the S1 form, and this enables him to look out for anything which needs special attention.

After painting machine is then ready for dispatch. All accessories are checked with record of those received and Works Foreman passes out machine as satisfactory.

Under this system it is very unlikely for a machine to go out unless it has been thoroughly overhauled, and if anything does go wrong we can generally tell how it went wrong and who was responsible.

Although it may sound very complicated it actually simplifies the work and enables us to handle many more machines with the same labour.

WIRING OZONERS

[FROM PAGE 84]

to receive the blocks. In the meantime, our cable ends would have been down under the paving covered with asphalt.

We got around this difficulty by securing 772 ordinary one-gallon tin cans and setting them bottom up in the trench over the two cable ends for each post, which were coiled and bunched up to go in the can. The bottoms of the cans were four or five inches under the grade line. When the excavations were made later for the posts, the cans were lifted off and the cable ends found to be in perfect condition. They were then pulled through the groove, sleeve and coupling, the block lined up and finally the ends pulled through the post and the latter screwed into place in the coupling.

Situated 240 ft. from the screen, on the center line of the lot, is the low building containing the projection room and a snack bar immediately behind it, separated by a solid partition. Lighting in the projection room is held to a minimum to avoid letting any considerable amount shine out through the openings for the projectors. Two projecting machines were installed initially, with provisions made for a third. This equipment was bought by the theatre company through the regular theatrical supply channels and installed by them. It is the electrical contractor's work to bring all service connections to them and to install to 40 h.p. motor-generator set incident to their operation. Low intensity overhead lights in this room are located in the ceiling, the operators not requiring much light for their work and light leakage, therefore, being held to a minimum.

From the patron's point of view, the drive-in theatre has many advantages. It is possible to watch the picture by reclining comfortably in your own sedan. Smoking is no problem in an ozoner. If you become cramped in a sitting position, you may get out of the car and stand awhile without obstructing someone else's view. It is possible for you to carry on a conversation with your companions and discuss the picture without annoying patrons in an adjacent car. Refreshments may be eaten in the car without annoyance to other patrons. Children may be put to sleep in the back seat while the parents view the picture from the front seat, thus avoiding the trouble of getting a sitter to stay with the youngsters at home.

New POSITIVE LOCK

Construction of

Monarch Renewable Fuses

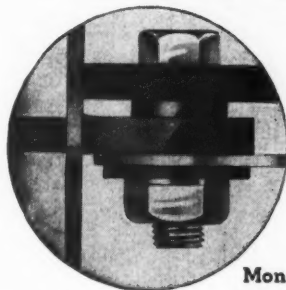
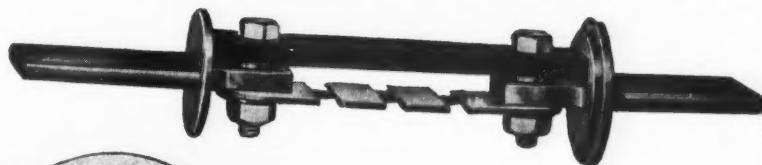
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The brass lugs inside the caps used on Monarch Fuses (see illustration at right above) fit into equally spaced slots in the brass casing inserts. This new and improved Monarch construction assures true alignment of the copper holding terminals . . . and establishes a positive lock on both ends of the fuse.

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MONARCH'S Compressed Tension Lock Washer construction (illustrated at left) compensates for contraction and expansion of the fibre bar by exerting constant tension on the bar . . . and assures no loose parts. The washer also separates the fibre bar from the copper terminals . . . a spacer to provide better cooling.

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ELECTRIC STOVE WIRE—For wiring or rewiring electric stoves, your best bet is Deltabeston electric stove wire. Smokeless and moisture-resistant types take the day-in, day-out beating of continued heat. For more information, write to Section Y29-218, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut, and ask us for the free booklet, *Deltabeston Wires and Cords*.



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(8) **CONTACTS AND BRUSHES**—Silver graphite and silver alloy contacts and brushes for special applications are specified and discussed in catalogue S-104. Superior Carbon Products, Inc.

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(10) **SWITCHGEAR AND CONTROLS** — Bulletin 25B7095 discusses switchgear and control devices, including rotary

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LIGHT DIMMING EQUIPMENT**

Judicious use of church lighting can intensify the atmosphere of dignity and reverence. The mere push of a button and the POWERSTAT motor-driven unit silently brightens or dims lights to set the mood for sermon, prayer or choir rendition. POWERSTAT light dimming equipment helps you achieve the proper lighting treatment; should be included in your plans for new building or for renovation.

POWERSTAT Dimmers, controlled by pushbutton, permit light dimming from one or several locations in the church. The pastor, in his pulpit, may vary light intensity to suit the mood desired for his sermon. The choir master, in his loft, may increase or decrease light brilliancy to complement the inspirational qualities of his music. A sexton, stationed at any location in the auditorium, may lower or raise lights to meet the need for brighter or dimmer lighting.

POWERSTAT light dimming equipment is easy and economical to install in your church — whether you're building a new structure or renovating and modernizing your present building. It handles incandescent or cold-cathode installations with equal effectiveness — provides trouble-free service. There's a POWERSTAT Dimmer for your application — whether your church is large or small, old or new.

We'll be glad to send you descriptive literature—write us today.

WRITE 6029 DEMERS AVENUE, BRISTOL, CONN.

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT



POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLY • STABILINE VOLTAGE REGULATORS

TOP QUALITY

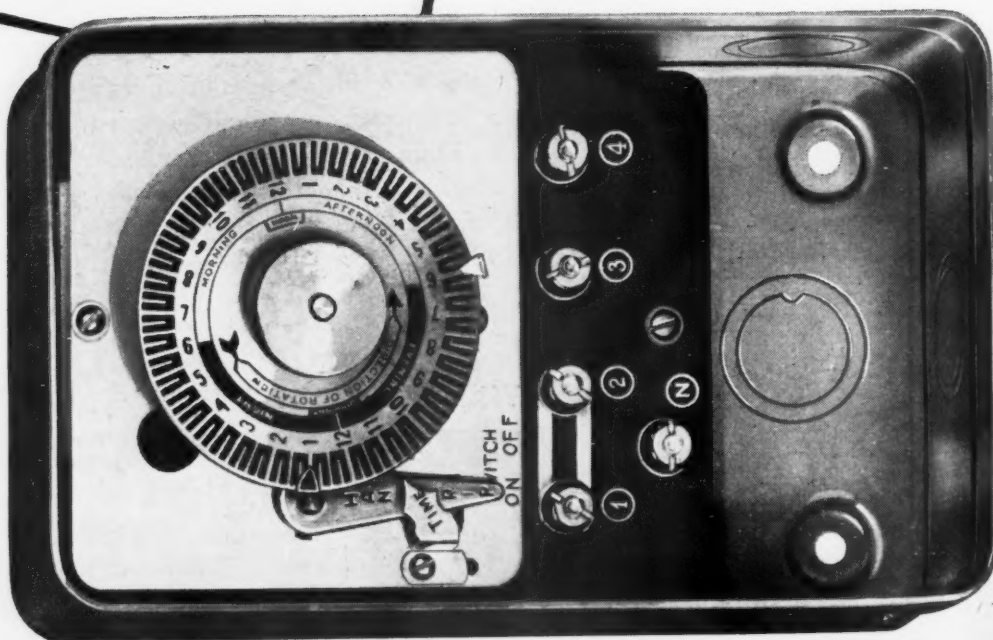
Paragon '301'

STANDARD TIME SWITCH

\$11.50
LIST

**WITH MORE
LIBERAL DISCOUNTS**

Now at the
**LOWEST
NET
PRICE**



No. 301

115 V., 60 Cycle
30 Amp., S.P.S.T.

Teleschron MOTORED



The BIGGEST TIME SWITCH NEWS for '49! Paragon standard "301" now at \$11.50 list—with more liberal discounts. Your net cost is now the same as the lowest-priced, standard time switches made! Why be satisfied with anything less than Paragon top quality?

SEE YOUR JOBBER OR WRITE

Paragon ELECTRIC COMPANY

1614 TWELFTH STREET

TWO RIVERS, WISCONSIN

In the News

Deferment of Apprentices Recommended By Committee

Because of the necessity of apprentice training to develop the skilled manpower called for in the national defense program, the Federal Committee on Apprenticeship recommended the deferment of apprentices who are under 24½ years of age and who have had as much as six months training under Federal or State standards of apprenticeship.

The resolution states that the committee is opposed to any blanket deferment of apprentices and that it is of the opinion that "the training of craftsmen through apprenticeship * * * is as vital to the national economy and security as is the training of military personnel," and that when "the drafting of apprentices in any specific occupation is likely to impair industrial production necessary to national security, then regulations should be issued to insure the deferment of apprentices on that occupation."

The Federal Committee on Apprenticeship, which is the national joint management labor, policy-recommending body for the Bureau of Apprenticeship, has recently been enlarged from 9 to 11 members—5 representatives of employers, 5 of labor and one of the U. S. Office of Education, who are appointed by the Secretary of Labor.

Among the speakers at the meeting were Secretary of Labor Maurice J. Tobin, Assistant Secretaries of Labor John W. Gibson and Ralph Wright. William F. Patterson, Director, Bureau of Apprenticeship, was chairman of the conference.

In his address, Mr. Tobin commended the employer and labor representatives on the committee for the get-together spirit they have demonstrated in the service they render in the national apprenticeship program. "The Federal Committee," he said, "is perhaps the most outstanding example in the United States Government of a fully functioning committee equally composed of labor and management. * * * While the meetings of the committee have rendered invaluable service in developing standards and policies on apprenticeship, one of the most significant contributions which the committee

has made * * * is that of promotional activities with the industries, organizations and associations which each member represents. * * * If we are to stiffen our industrial structure to secure increased productivity of the American worker in order to meet our foreign commitments and raise the standard of living at home, we must accord all possible governmental, management and labor support to the apprenticeship program of the country."



William B. Heaps Dies

William B. Heaps, Central District Manager of *Electrical Construction and Maintenance*, died suddenly of a heart attack on December 25th at the age of 52.

During his 27 years in advertising and publishing, Bill Heaps was one of the most widely-known personalities among electrical men in the middle-west. He attended the University of Chicago, Lombard College, and Marquette University, leaving school to become a Lieutenant in the United States Army during World War I. He joined the Electrical Trade Publishing Company in 1922 and worked on the *EMF Electrical Year Book*. When his company, which later became a part of the McGraw-Hill Publishing Co., purchased *Electrical Contracting*, he started his long career on

this publication, which continued until his death.

He also represented *Electrical Wholesaling*, the McGraw-Hill Catalogs and in recent years, *Electrical West*. He was a member of the Chicago Industrial Advertisers Association, a chapter of the National Industrial Advertisers Association.

Dean Rusk Heads Farm Electrification Conference

H. P. Rusk, dean and director of the University of Illinois College of Agriculture, was elected 1949 chairman of the National Farm Electrification Conference at the Chicago meeting of that group. Dean Rusk succeeds Frank E. Watts, executive assistant of Farm Journal, Inc., New York City.

Other officers elected at the 1948 Conference were: vice-chairman—Titus B. Schmidt, president, Crescent Supply Company, Dubuque, Ia.; secretary-treasurer—Karl Gorham, business manager, Electricity on the Farm, New York City.

Re-elected as regional vice-chairmen were: R. B. Corbett, University of Maryland, College Park, Md.; J. B. Rodgers, Oregon State College, Corvallis, Oregon; P. D. Sanders, master, Virginia State Grange, Richmond, Va.; P. T. Montfort, A & M College, College Station, Texas; H. E. Slusher, president, Missouri Farm Federation, Jefferson City, Mo.; and E. G. Stahl, Pacific Gas and Electric Company, San Francisco, California.

Organized to bring together individuals and groups interested in raising farm living standards and reducing production costs through profitable use of electricity on the farm, the conference attracted representatives of 25 national organizations from several states throughout the country.

Conference theme was: Meeting the Farm Family's Needs Electrically. Several panel discussions unearthed numerous suggestions as to how the power suppliers, electrical dealers, home economists, farm press and other groups could help the farm family in securing the vast advantages offered by electrification. Farm wives added a domestic touch to the conference by recounting what electricity has done for them in the farm home.

New **STEBERLITE**

SPOT and FLOODLIGHTING



Steberlite Floodlamp Holder S 300 can be installed on conduit fittings, wall brackets or pole slip fitter.

Greatly Widens Lighting Applications

Steberlite, the new lamp holder for 150 watt Par-38 and R-40 lamps, provide flexible inexpensive means of spot and floodlighting business areas, playgrounds, gardens, camps, courts, parking lots, sport and amusement centers—for improved appearance, utility and safety.

Mount Them Singly—in Pairs or Clusters of 3, 4, and 5

Besides better general lighting, Steberlites can be used to direct special attention to displays, statues, buildings and entrances. They can be used singly, in pairs or clusters of 3, 4 and 5. Being compact, weather-proof and completely wired, they are ready for quick assembly and installation indoors or out.

Few Parts to Stock

Just *four* basic units are necessary to serve most requirements—a small inventory does a big profit job. Here's all that is needed:

1. Steberlite Floodlamp Holder . . . S 300
2. Steberlite Adapter Box S 301
3. Steberlite Pipe Slip Fitter S 302
4. Steberlite Accessories and Fittings.

Sold Through Leading Wholesalers



LIGHTING UNITS

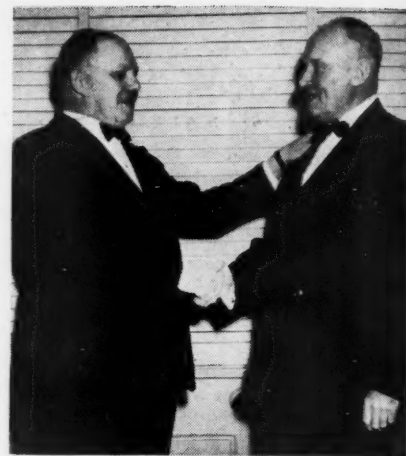
STEBER MANUFACTURING CO.

2700 ROOSEVELT ROAD, BROADVIEW (MAYWOOD P. O.), ILLINOIS



Write for new Bulletin 120

By use of Adapter Box No. S 301, clusters up to 5 Steberlites can be quickly assembled as one unit and this in turn fitted to 1½" or 2" pipe or for direct connection to conduit.



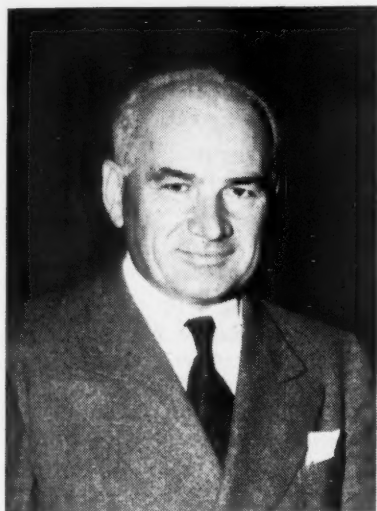
PLEDGE COOPERATION IN BUILDING — George Meany, secretary-treasurer of the American Federation of Labor, congratulates Peter W. Eller on his appointment as permanent chairman of the board of governors of the Building Trades Employers' Association of New York City. Mr. Meany, in his speech at a testimonial dinner to Mr. Eller attended by 1200 builders, public officials, investors, material manufacturers and officers of international labor unions at the Waldorf-Astoria Hotel, Thursday, Jan. 13, conceded that the administration of the Wagner Labor Relations Act had been biased in favor of employees and made a plea for labor legislation that would be fair to both employer and employee. Mr. Eller, as top administrative officer of the multi-million dollar building industry in Greater New York, predicted peace and prosperity for the industry.

Farm electrification leaders revealed the progress made over the past years. Today there are over 4,000,000 farms electrified, compared to 393,000 in 1927 and a predicted total of 5,400,000 in 1957 (there are approximately 6,000,000 farms in the United States). During the next ten years, the average power consumption per farm will approach 4,000 to 5,000 kilowatt hours annually, it was noted. During this decade, it is estimated that farmers will invest \$4,000,000,000 in electrically operated home appliances and \$1,350,000,000 more for electrical components, such as motors, switches and controls for electrically-driven farm production equipment. This does not include the cost of the machines for which additional huge sums will be spent.

Research is constantly developing new farm production processes that require electrical energy, the conference was told. Within the next five or six years, crop-conditioning units—such as artificial corn driers—will be common farm equipment, it was predicted. Also being investigated, are the possibilities of using high frequency radiation to pasteurize and homogenize milk in a single operation;

to control enzymatic action in grains and to control bacteria in eggs.

If the farmer is to reap the full benefits of the combined research of federal and state governments, university agricultural stations, and electrical equipment manufacturers, he must be kept constantly informed of developments. Only through the cooperative efforts of farm groups, university and government agricultural departments, as well as electrical manufacturing, dealer and installation groups, can this tremendous education task be accomplished, industry leaders told the conference.



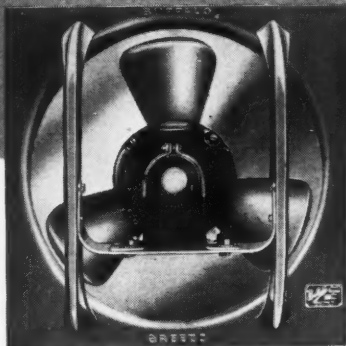
F. P. Coffey Elected President of E.I.B.

Electrical Contractor Frederick P. Coffey was elected president of the Electric Institute of Boston, Inc. at its fourth annual meeting held on January 13 at the Hotel Statler, Boston. The dinner was attended by more than 600 members and guests, representatives of all branches of the industry.

William H. MacCrellish, Graybar Electric Co., Inc., presided. The annual report of the managing director was given by John G. Waddell and he outlined the various training courses that have been set up under the sponsorship of the Institute. He also read the report of the treasurer in the absence of Ralph E. DeLoid, Westinghouse Electric Supply Co.

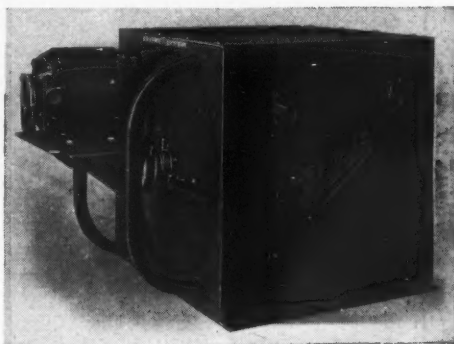
The retiring president William H. Kaiser of General Electric Supply Corp. reported that the program of the Adequate Wiring Committee, started during the past year, has made real progress. He stressed the importance of this program, which will benefit all branches of the electrical industry, and urged attendance by the Institute at the National Adequate Wiring Conference to be held in Chicago the end of February.

Unlimited Uses for these Durable Quiet-Running fans —



"Buffalo" PANEL
BREEZE FANS

VENTILATING kitchens, restaurants, bake shops, small theatres, engine and boiler rooms are just a few of the hundreds of NEEDED applications of these compact fans. In fact, wherever relatively large volumes of air at low pressure are desired in exhausting hot vapors or gases, or general ventilation, this propeller design is ideal. Quiet operation, low cost, freedom from maintenance worries, wide popularity with contractors and users alike make BREEZE FANS excellent to carry. 8" to 24" sizes.



Hood and Vat
Exhausting is a
B-R-E-E-Z-E
with the

"Buffalo"
"L"
BREEZO

THE motor is protected from the air stream in this unit with the enclosed Breeze fan! Sizes to fit your requirements. 12" to 36" for as high as 7300-cfm at $\frac{1}{4}$ " static pressure. Note the easy access to the fan through the handy side door. Here's a self-contained unit for exhausting vapors, fumes and gases—for simplified mounting on hood. Better get prices, terms and engineering data on these fast-selling "Buffalo" fans!

"Buffalo"
"First
For Fans"

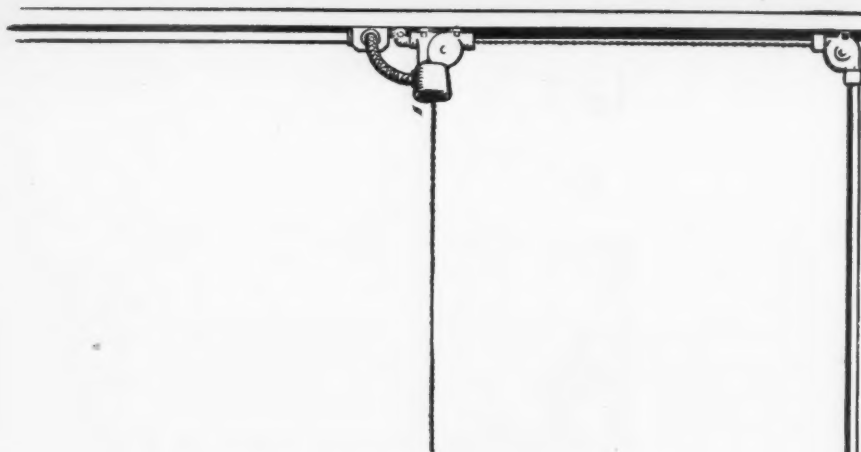
BULLETIN 3222-F tells you all about these and other profitable, proven "Buffalo" fans. Write for your copy!

PERMANENT SATISFACTION IN AIR HANDLING

**BUFFALO FORGE
COMPANY**

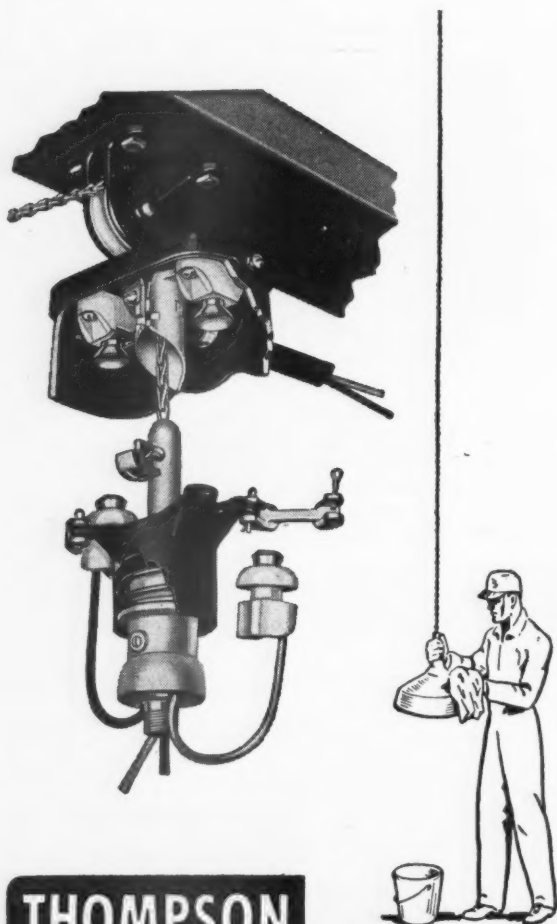
520 BROADWAY, BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd.,
Kitchener, Ont.
Branch Offices in all Principal Cities

BREEZO FANS
BELT AIR FANS
BELTED VENT SETS
"E" BLOWERS



You can clean, maintain and relamp your High Bay Lighting Fixtures **CHEAPER** with Thompson Disconnecting and Lowering Hangers.

We invite you to use our engineering service.



T E

THOMPSON
DISCONNECTING & LOWERING
HANGERS

THE THOMPSON ELECTRIC CO.
1101 POWER AVENUE • CLEVELAND 14, OHIO

C. C. Walker was presented with a testimonial in the form of a sterling silver cigarette box by the members of the Institute for his years of service in the Boston area. Thomas H. Carens, vice president, made the presentation. Mr. Walker, who was recently appointed a vice president of General Electric Company in charge of the Construction Materials Department, is leaving Boston to take up his new duties in the G-E Bridgeport, Conn. headquarters.

In his remarks in accepting the presidency for 1949, Frederick P. Coffey, Anderson-Coffey Co., Inc., stressed the importance of continuing the work of the Adequate Wiring Committee and the innumerable educational activities of the Institute. "Business thinking today is of the opinion that the post-war demand for goods and services has reached the saturation point to the extent that a salesman, instead of sitting at his desk and taking orders over the telephone, has to go out to see his customer in the attempt to get orders," he continued. "To those salesmen who are smart enough in the selling of a prospect to educate him on the new and improved electric equipment and appliances of today, he will find plenty of potential business ahead of him for the coming year. But those who just call on their customers with something to sell without enlightening them to our new products might run into some difficulty in taking orders. It will be a long time and many years away before we will have difficulty in selling our modern electric switchgear, motors, appliances, television sets, and last but not least our new methods of electric heating," said Mr. Coffey.

The other officers elected were for vice president, Thomas H. Carens of Boston Edison Company; treasurer, Ralph E. DeLoid of Westinghouse Electric Supply Co.; secretary, Edward Bass, Edward Bass Electric Co.; and assistant secretary, James A. Galvin, Boston Edison Company.

Chicago Groups Elect '49 Slate

George W. Reinke, George W. Reinke Electric Company, Chicago, was re-elected president of the Cook County Electrical Contractors Association at the annual election meeting of that group. Leo W. Witz, Continental Electrical Construction Co., serves another term as vice-president. Victor Jensen, Jensen Electric Co.; and Erwin Kaufmann, Kaufmann Electric Co., are the new secretary and treasurer respectively.



All service and minor manufacturing activities of Hannon Electric Co., Canton, Ohio, electric motor repair shop, are the responsibility of the electrical engineer Alvin E. Frick. Before coming to Hannon, he was plant engineer at Diebold, Inc., Canton for about seven years.

Incumbents re-elected to the Board of Directors are: Frank M. Block, Block Electric Co.; Robert Darby, Okeh Electric Co.; H. E. Hartmann, Roberts-Stage Electric Co.; Abe Sluis, Sluis Electric; and A. A. Wohlgezogen, Builders Lighting Fixture Company. New members of the Board are B. L. McClain, Horton Electric Co., La Grange, Ill.; and W. J. Templeman, Premier Electric Construction Co., Chicago.

At the annual election of the Electric Motor and Service Association (Central District Chapter, NISA), Paul M. Sievert, Sievert Electric Co., was chosen president of the motor shop group. J. G. Lessel, Central Motor and Repair Co., is the new vice-president. Other newly elected officers are: secretary—H. W. Reeve, Inland Industrial Electric Service Co.; treasurer—A. J. Jefferies, Bowers and Clark.

Elected to a 3-year term on the EMSA Board of Directors are G. F. Glave, Chicago Electric Company; and E. S. Michaletz, Condo Electric Co. Present Board members serving unexpired terms include: Thomas Agosto, Baird Rogers, Joseph Borovec and Burton R. Hohman.

Installation of officers and directors took place at the January meeting of each group.

President's Message Asks Unprecedented Spending for Power

President Truman asked Congress to finance federal power operations on an unprecedented scale in his annual budget message.

Here's a type of job worth going after



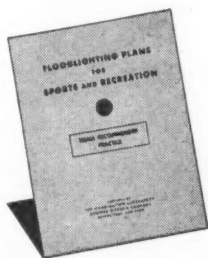
This is Simmons Field, Kenosha, Wisconsin. It is a good example of a type of floodlighting job worth going after.

Simmons Field planned lighting uses the standard G-E "160" lighting system. Everything planned, ordered, and installed according to "the book." These plans which represent years of floodlighting engineering experience specify everything to assure a perfect lighting job—from the exact location of the 80-foot steel poles to the aiming of the 160 L-69 floodlights.

Floodlighting installations are going in all over the country—Kenosha has five lighted fields. They can be handled by any competent contractor even though he has had no previous floodlighting experience. They should yield a satisfactory profit—and frequently they carry, with the initial installation, a year-after-year maintenance contract.

Apparatus Department, General Electric Company, Schenectady 5, N. Y.

YOURS FOR THE ASKING—This is "the book" that contains 38 complete floodlighting plans for sports and recreation. One is the "160" lighting system used at Simmons Field—160 G-E floodlights on ten 80-foot steel poles—complete with a list of all material required down to concrete and paint. Among other plans are tennis courts, volley ball and 12- to 48-lamp softball fields. Ask your G-E distributor for it as bulletin GET-1284 or if he cannot supply you write us direct.



THE SPORTS-LIGHT—This is the floodlight used at Simmons Field—the G-E L-69. It gives more light per unit, more light per watt, is easier to install and cheaper to maintain than any other comparable unit. It's so good that four major-league parks use it, so economical that it's the favorite for sand-lot softball. Bulletin GEA-4835 gives complete description and prices.



GENERAL ELECTRIC

451-124

QUAD

LIGHTING UNITS

ARE BUILDING
BUSINESS
FOR US....



QUAD

LIGHTING



QUAD sign lighting types include fifteen different sizes and shapes ranging from six inch round for 40 watt lamps to eighteen inch rectangular for 1500 watt lamps. All are finished in permanent porcelain enamel—green outside with a lustrous white inside reflecting surface. Fittings are thoroughly rustproof. Reflectors are removable and interchangeable on all three types of socket-fittings, which include type "H" for attaching to horizontal pipe—type "V" for suspending reflectors on vertical pipe and type "B" for mounting direct to outlet box.

SEE US AT BOOTH 44



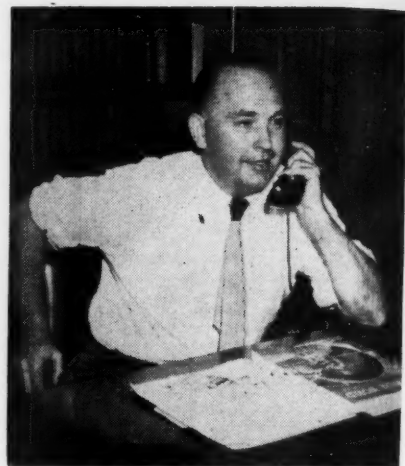
• For that extra efficient sign lighting job sell Quad Sign Reflectors—Round Angle, Spade and Rectangular types. Each is easy to wire and to attach reflector.



QUADRANGLE MFG. CO.

32 S. PEORIA ST.

CHICAGO 7, ILL.



Staunch advocate of modern tools is C. Allen Harlan, president, Harlan Electric Company, Detroit, Michigan. A rapidly expanding electrical engineering and construction firm, Harlan Electric now has affiliate organizations in Ohio, Tennessee, Indiana and Wisconsin.

Actual costs, next year and in the future, of electric power facilities contemplated for fiscal 1950 were buried in a welter of budget estimates for multiple-purpose projects. But by almost any conceivable method of comparison they looked bigger than ever.

On the basis of funds to be provided by Congress for the fiscal year, the power programs look even larger. With a few exceptions—notably the Rural Electrification Administration—federal agencies involved in construction of electric power facilities or other power activities were slated for record appropriations. The President asked Congress to appropriate a total of \$2,404,000,000 and grant contract authorizations aggregating \$451,300,000 for such bureaus.

Even REA, which was put in for new loan authorizations of \$350,000,000—as against the 1949 allotment of \$400,000,000—got a better break on its lending program than this request would indicate. With an anticipated carry-over of previous loan funds totaling \$119,000,000 at the start of the fiscal year, it will have \$469,000,000 for loans. It expects to advance a total of \$360,000,000 out of this sum.

But the President also recognized that REA's job is nearing completion. The agency's program, he said, "may be expected to level off in 1951 and decline in later years."

He expressed no such views in regard to other federal construction programs. Power shortages in several areas, he warned, are of a "permanent" nature. He thus justified increased expenditures for power construction by the Army's Engineers, Interior's Reclamation Bureau, Bonneville Power Administration, and the Tennessee Valley Authority.

Dates Ahead —

American Institute of Electrical Engineers—Winter general meeting, Pennsylvania Hotel, New York, N. Y., January 31-February 4, 1949.

Electrical League of Milwaukee—Annual industry dinner dance, Hotel Schroeder, February 12.

National Association of Home Builder's Convention and Exposition—Stevens Hotel, Chicago, Ill., February 20-24.

National Adequate Wiring Bureau—Fifth annual adequate wiring conference, Stevens Hotel, Chicago, February 24-25.

Rural Electrical Contractors Association—Convention, Edgewater Beach Hotel, Chicago, Ill., Feb. 24-26.

North Central Electrical Industries—All-Industry Convention, Radisson Hotel, Minneapolis, Minn., February 27-March 2.

Exposition of Electrical Progress—Sponsored by the Electrical Association of Kansas City, Municipal Auditorium, Kansas City, Mo., March 2-6.

National Electrical Manufacturers Association—Winter convention, Edgewater Beach Hotel, Chicago, Ill., March 13-18, 1949.

Third International Lighting Exposition and Conference—Hotel Stevens, Chicago, Ill., Week of March 28, 1949.

Midwest Power Conference—11th annual conference, Sherman Hotel, Chicago, Ill., April 18-20.

National Electrical Wholesalers Association—41st Annual Convention, Netherland Plaza Hotel, Cincinnati, Ohio, May 1-6.

Chamber of Commerce—37th annual meeting, Washington, D. C., May 2-5.

National Fire Protection Association—53rd annual meeting, Fairmont Hotel, San Francisco, Calif., May 16-19.

National Industrial Service Association—Annual convention, St. Louis, Mo., June 6-8.

New York State Association of Electrical Contractors and Dealers, Inc.—Saranac Inn, N. Y., June 25-July 1.

Illuminating Engineering Society—National Technical Conference, French Lick, Ind., September 19-23.

International Association of Electrical Inspectors—Western Section, Hotel Radisson, Minneapolis, Minn., September 26-28; Northwestern Section, Butte, Mont., October 3-5; Southwestern Section, Hotel San Diego, San Diego, Calif., October 10-12; Southern Section, Hotel Shamrock, Houston, Texas, October 17-19.

National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., November 13-18.

Manufacturers News

WYLIE BROWN ELECTED CHAIRMAN OF PHELPS DODGE

Wylie Brown, president of Phelps Dodge Copper Products Corporation, has been elected chairman of the board of directors and will continue as chief executive officer of the corporation.



WYLIE BROWN

GENERATE YOUR OWN

ELECTRICITY

FOR ANY PURPOSE—AT LOW COST

with a

Universal ELECTRIC PLANT

GASOLINE AND DIESEL MODELS TO 35 kw.

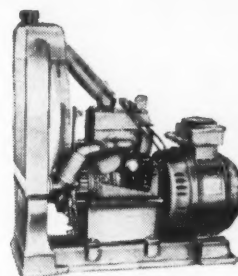
Whether you want a dependable source of electricity to beat the power shortage—or for permanent service or emergency standby use—you'll find exactly the size and type electric plant in the complete Universal line. Here are both gasoline and diesel models, in portable and stationary types—with each model backed by Universal's over 51 years of manufacturing experience. Soundly engineered and of highest quality construction, Universals offer maximum operating economy and dependability. Yet, prices are as low as any.

Universal gasoline powered electric plants are built in sizes from 250 watts to 25 kw., air or water cooled, portable or stationary types. The complete Universal diesel line ranges from air-cooled models of 2000 watts up to powerful 6-cylinder units of 35 kw. All types of controls, manual or fully automatic.

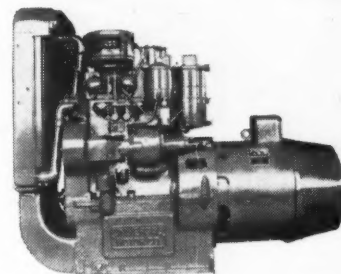


SEND FOR BOOKLET, "Electricity at Low Cost," for facts and photos of Universal's gasoline-powered electric plants. Also ask for bulletins on Universal diesel models.

Contractors and Representatives: Write for full details on the profitable Universal franchise.



This small 2-cylinder, water-cooled Universal electric plant provides 2500-3000 watts. Extremely dependable, unusually economical. Other Universal gasoline models to 25000 watts.

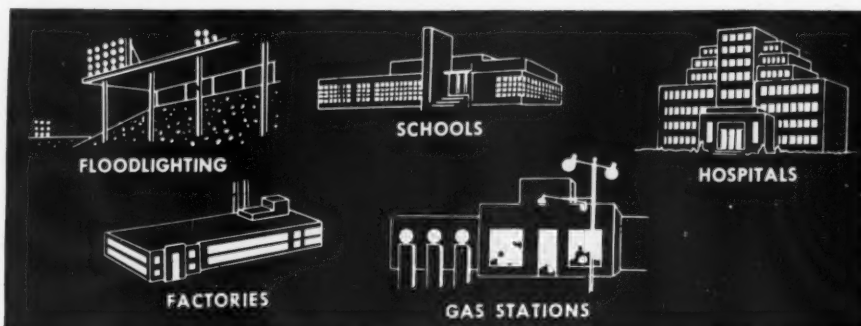


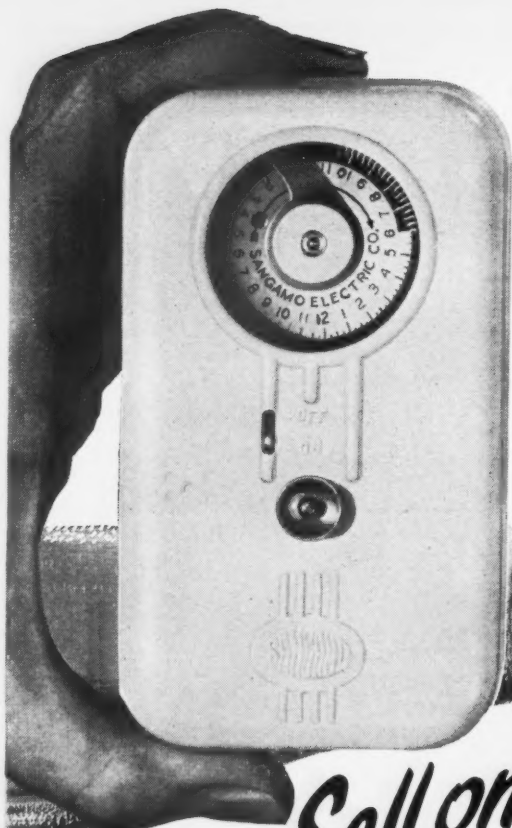
For 10 kw. of low cost electricity, this Universal diesel-powered electric plant should be investigated. Send for bulletins covering Universal 100% full diesel electric generating sets.

UNIVERSAL MOTOR COMPANY

Founded 1898

438 Universal Drive • Oshkosh, Wisconsin





SANGAMO Type S TIME SWITCHES

Single Pole,
Single Throw
Rated 15 Amp.

They Sell on Sight...

You can get more business with these fast-moving, precision-built miniature time switches. Their high quality, small size and low cost permit the convenience of automatic control in many new time switch applications. Make extra sales by stocking and *pushing* Sangamo Type S Time Switches. They are available for immediate delivery. Bulletin 1053A gives complete information.

This attractive counter display will help you sell more Type S Time Switches. Ask for this business-getting sales help for your counter. Write today.



SANGAMO

ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

51494

174

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . FEBRUARY, 1949



WHIPPLE JACOBS

Whipple Jacobs, formerly president of the Belden Manufacturing Company of Chicago, has joined the Phelps Dodge Copper Products Corp. as president.

Mr. Brown has been president of the corporation since it was founded and both he and Mr. Jacobs are widely known in the copper industry.

GENERAL ELECTRIC CHANGES

Operations of the Wire and Cable Divisions of the Apparatus and Construction Materials Department of the General Electric Company have been consolidated, according to an announcement by Charles E. Wilson, president. Overall responsibility for that portion of wire and cable business formerly assigned to the Apparatus Department, Schenectady, has been transferred to the Construction Materials Department, with headquarters at Bridgeport, Conn.

B. F. Ilsley, heretofore manager of the Apparatus Wire and Cable Division, has been named manager of the expanded Wire and Cable Division, according to C. C. Walker, general



B. F. ILSLEY

manager of the Construction Materials Department and vice president of the General Electric Co. Mr. Ilsley will be responsible for all operations of the Wire and Cable Division, including engineering, manufacturing and sales.

Opening of a new plant at Circleville, Ohio, for the manufacture of slimline fluorescent lamps has been announced by the Lamp Department of G-E.

Manager of the lamp works is Edward G. Grigg, who joined G-E in 1936.

The Apparatus Department has established a separate sales district for the state of Michigan, with headquarters in Detroit. Formerly a part of the Central District with headquarters in Chicago, the newly-constituted Michigan district will include present local sales offices in Detroit, Lansing, Jackson, Grand Rapids, and Saginaw. A. R. Hines, formerly manager of the Apparatus Department office in Philadelphia has been named manager of the Michigan District; and V. J. Snyder and C. M. Dunn, now assistant managers of the Detroit local apparatus office, as assistant managers of the new district.

The appointment of John J. Huether as manager of Central Station Divisions has been announced. He succeeds Ralph M. Darrin, who has been elected a commercial vice president assigned to customer relations work in the New England territory.

MINNESOTA MINING APPOINTMENTS

The advancement of three technical men in the newly formed "Scotch" sound recording tape division of the Minnesota Mining & Manufacturing Co., St. Paul, Minn., has been announced.

Dr. W. W. Wetzel, former assistant director of the company's central research laboratories, has been appointed technical director for the recording tape unit.

Assistant research director is Dr. Lew W. Cornell. Prior to this promotion he was chief chemist for research and development in the tape division.

Melvin C. Hegdal has been promoted from products supervisor to the post of operations manager in the production of sound tape.

SYNTRON APPOINTMENTS

Syntron Company, Homer City, Pa., has announced the appointment of Mark Chisholm as district sales manager of the newly established sales office in Des Moines, Iowa.

Ernest K. Hood has been named district sales manager of a new sales office in Kansas City, Mo.

R. K. Bentzien has been added to the Milwaukee, Wis. sales office staff.

CORNELL-DUBILIER PURCHASES RADIART CORP.

Octave Blake, president of Cornell-Dubilier Electric Corporation, South Plainfield, N. J., has announced the purchase from Maguire Industries, Inc., of all of the stock of Radiart Corporation, of Cleveland, Ohio. The Radiart plants will be operated in

SANGAMO Type L TIME SWITCH

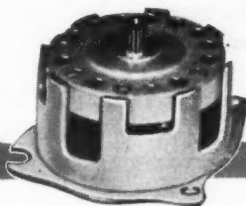
Synchronous
for Heavy-Duty
Applications



Sangamo heavy-duty Time Switches, long known for their high quality, now have new features that make them better than ever! These improvements include modern styling, a gasket sealed, pressed-steel case, and closer time limits between settings which permit a wider range of applications. They can be equipped with a number of control features, such as an omitting device or astronomic dial. Write for Bulletin 1060A.

New Hysteresis-type Motor

The new Sangamo-developed hysteresis-type motor, used in all Sangamo Time Switches, features greater torque... long-life lubrication... low speed—your assurance of better performance.



SANGAMO ELECTRIC COMPANY

SPRINGFIELD • ILLINOIS



YOU CAN BE **SURE**.. IF IT'S

Westinghouse



MORE *"Muscle"*
FOR ELECTRICAL APPARATUS
...at no extra cost

Your apparatus can have higher electrical stamina . . . longer operating life . . . if insulated with Westinghouse "Tuffernell" Insulating Varnishes.

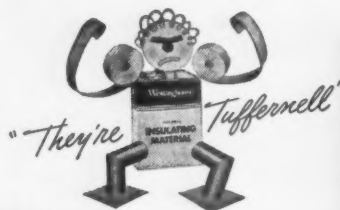
Outstanding among these new varnishes are Tuffernell B-161, B-163, and B-165. All are thermosetting; and each has specific properties of high resistance to heat . . . moisture . . . centrifugal force . . . and to other enemies that break down ordinary varnishes.

It is because of these properties that Baker-Raulang, of Cleveland, chose Tuffernell B-163 for their well-known line of industrial trucks, tractors, and cranes. They like B-163's deep penetration of windings, giving better heat transfer and cooler-running motors. They have found, too, that B-163 is economical and faster to use, and stands up in rugged service.

The complete Tuffernell line includes Insulating Varnishes and Compounds for your application. All are described in Bulletin 65-120, available on request.

Investigate Tuffernell today for your needs. Call your nearby Westinghouse office, or write Westinghouse Electric Corporation, Dept. 12, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-06418



Westinghouse
TUFFERNELL INSULATING VARNISHES
— for every electrical need

Cleveland as a separate division of Cornell-Dubilier.

New officers of the Radiart Corporation are: Octave Blake, president; L. K. Wildberg, vice president; Verne Mitchell, vice president, and C. A. Staub, treasurer and assistant secretary.

ILLINOIS ELECTRIC PORCELAIN APPOINTMENTS

The Board of Directors of Illinois Electric Porcelain Co., Macomb, Ill. has elected A. G. Benard as vice president and general manager. At the same time, his son, Raymond H. Benard, was appointed sales manager of the company.

WESCO APPOINTMENTS

Earl E. Whitlock has been named branch manager of the Yakima, Washington office of the Westinghouse Electric Supply Company. He will succeed J. R. Wells, who will be transferred to the North Pacific District headquarters at Seattle, in charge of district claim procedure.

D. A. Womeldorff has been appointed district farm sales supervisor for the Northwestern district, with headquarters in Chicago, Ill. Prior to this appointment, he worked in a similar position for General Electric.

A. F. FISHER NAMED PRESIDENT OF TELECHRON

The board of directors of Telechron Inc. has accepted the resignation of I. W. Kokins as president of the corporation, because of ill health. He will continue as a director and will serve in an advisory and consulting capacity.

A. F. Fisher has been elected president to succeed Mr. Kokins. He joined Telechron in 1945 as manager of manufacturing and engineering. On April 1946, he was elected vice president and in 1947 executive vice president.

SWIVELIER APPOINTMENTS

The following changes have been made in the national sales organization of the Swivelier Company, Inc., New York City:

Herbert C. Zang, 838 Starin Avenue, Kenmore, N. Y. will cover New York State, north of Poughkeepsie.

In addition to their present territory, the George Butler Company of Chicago will cover the entire states of Wisconsin, Minnesota, and North Dakota, also Michigan's Upper Peninsula.

The Northwestern Agencies, Inc., Seattle, Wash., will cover the states of Montana and Idaho, in addition to their present territory.

CURTIS APPOINTMENTS

Curtis Lighting, Inc. of Chicago, Ill. has appointed two new sales representatives.

Edward I. Creed will represent the company in the Philadelphia area. He formerly managed the C & S Lighting Maintenance Company of Cleveland. W. P. O'Reilly will cover the Cleveland area. Mr. O'Reilly was formerly sales manager of the fluorescent division of Crescent Metal Products, Inc., of Cleveland.

WINCHARGER CORP. CHANGES

George H. Calhoun, sales manager of domestic Wincharger Division of Wincharger Corporation, Sioux City, Iowa, has been appointed to the newly created staff position of sales development engineer.

Clark D. Murphy, formerly regional supervisor of Wincharger Corporation, assumes the duties of sales manager of domestic Wincharger Division, succeeding Mr. Calhoun. Don Moline, chief designing engineer, has been named to the newly created position of sales engineer, assisting the sales manager of the Rotary Electrical Division.

ROME CABLE ANNOUNCES NEW COAST SALES ORGANIZATION

Rome Cable Corporation, Rome, N. Y. has announced the establishment of its own sales offices on the Pacific Coast. O. I. Lewis has been appointed Pacific Coast sales manager with headquarters in Los Angeles, Calif.

In addition to a headquarters office in Los Angeles, the new sales organization will include district sales offices in Los Angeles with H. S. Warren as manager; San Francisco with C. H. Kaufman as manager; Seattle with K. B. Arnett as manager; as well as offices in Portland, Ore. and Salt Lake City, Utah.

In addition to its regular wire and cable line, Rome Cable Corporation will handle all sales of the products of Andersen-Carlson Manufacturing Company of Torrance, Calif.

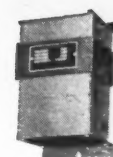
Hazard Insulated Wire Works Division of the Okonite Company, Wilkes-Barre, Pa. has announced the appointment of Thomas R. Weichel as mining electrical engineer of the sales department. Mr. Weichel was formerly with the United States Bureau of Mines.

The Black & Decker Mfg. Co. of Towson, Md., has moved its Chicago Sales and Service Station to a new building located at 1100 W. Jackson Blvd.

SORGEL AIR-COOLED TRANSFORMERS

Prompt Deliveries of Dry-Type Transformers

50 Kv-a. and smaller
usually from stock



1/4 Kv-a.
Single Phase
460/230 to
115 volt

A size and type for
every purpose.

1/4 Kv-a. to 2000 Kv-a.

All voltages.

Single phase and 3-phase.



3 Kv-a. 3-phase
Wall Mounting Type

Liberal Design.

Steel Encased.

Solderless
Terminals.

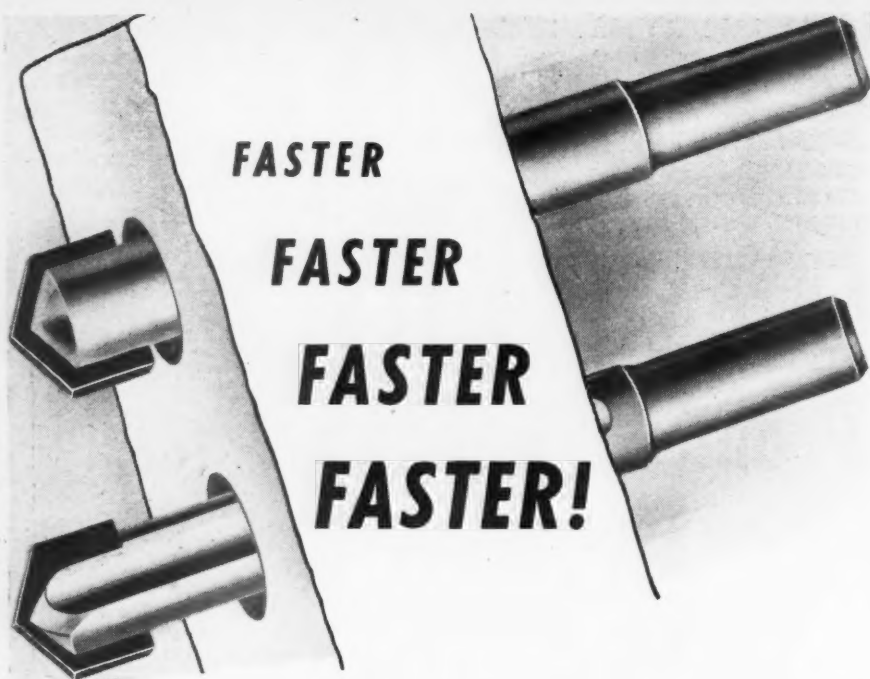
Connection
Compartment.

Quiet Operation.
Low Temperature.
High Efficiency.
Long Life.
Priced Right.



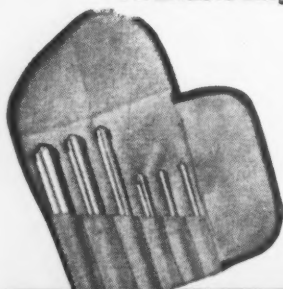
100 Kv-a. Single Phase
Floor Mounting Type

SORGEL ELECTRIC CO. 836 W. National Ave., Milwaukee 4, Wis.
Pioneers in the development and manufacturing of Air-Cooled Transformers



NOW... DRILL MASONRY UP TO 4 TIMES FASTER!

- Two styles (fluted or round shank) for deep or shallow holes
- Wide range of sizes
- Carboloy Cemented Carbide tips drill any masonry
- Drills stay sharp up to 50 times longer
- Fit any standard rotary drill press, or hand brace
- Drill clean, accurate holes . . . quietly
- Available singly or in 3 handy kits of six assorted sizes each



No wonder these rotary drills work so fast, stand up so long. The tips are made of Carboloy Cemented Carbide—the hardest metal made by man!

Send the coupon for more information about these time- and money-saving drills, and about the three handy assortments.

CARBOLOY[®]

CEMENTED CARBIDE

MASONRY DRILLS

CARBOLOY CO., INC., 11175 E. 8 Mile Road,
Detroit 32, Michigan

Gentlemen:

Please send me free Folder SA 236, containing prices and specifications on Carboloy Masonry Drills.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

The Glidden Engineering and Equipment Company of Houston, Texas has been named sales agent for **General Switch Corporation** of Brooklyn, N. Y. They will cover the territory of Texas and Oklahoma through their offices in San Antonio, Dallas, Amarillo and Houston.

The J. C. Richards Company of Los Angeles has been appointed sales agent for the Southern California territory.

The Wheeler Insulated Wire Company, Inc. of Bridgeport, Conn. has named George B. Horn, as vice president. He was formerly secretary and assistant general manager; George T. Mumaw, formerly treasurer, has been appointed secretary and treasurer.

William Decter, Inc. of Harrison, N. J. has taken over the management of Preferred Lighting Co., Brooklyn, N. Y. The company will be known as **Royaline-Preferred Lighting Corp.**, with headquarters in Harrison, N. J.

S&C Electric Company, Chicago has announced the appointment of Laurence M. Rudbeck as sales engineer for the Indiana, Western Kentucky, Southern Illinois territory, with headquarters at 310 Test Building, Indianapolis, Ind.

Cutler-Hammer, Inc. has moved its Indianapolis sales office to new quarters at 644 E. Maple Road.

E. S. Holt has been appointed branch manager of the Emeryville, Calif., plant of the manufacturing and Repair Division, **Westinghouse Electric Corp.**

The Slater Electric & Mfg. Co., Inc. has recently completed a \$50,000. wing on its plant at 56th Street and 37th Avenue, Woodside, New York.

A. J. Fischer has been named manager of the Dayton Branch of **Graybar Electric Company**.

J. H. Burrus has been promoted from assistant manager to manager of the **Allis-Chalmers** Portland district, succeeding F. V. Sams, who is returning after 43 years of service.

Claude V. Harp, Jr. has been named field sales engineer in the Houston, Texas office of the **Reliance Electric & Engineering Co.**

EQUIPMENT NEWS

[FROM PAGE 112]

Switch

The new Unimax model KMX metal-cased precision switch, provides simplified mounting for both basic switch and metal housing. It gives sealed protection against splashing oil, moisture and abrasive. Switch mounts in metal housing, by means of a slip fit, on two pins which are integral with the side plate and whose centers fit standard mounting holes of the switch. Metal housing can be installed without basic switch; for side mounting, with threaded studs which project from side plate; for base mounting, by taped base holes or adapter flange. Side plates are removable and interchangeable, permitting either left or right hand mounting. Conduit hub connection has an internal $\frac{1}{2}$ inch pipe thread. Overall dimensions of the aluminum housing are: 1-13/16 in. high, 2 $\frac{1}{4}$ in. wide, $\frac{7}{8}$ in. deep. Unimax Switch Division of the W. L. Maxson Corporation, 460 West 34th Street, New York 1, N. Y.

Drive

A new low cost Thy-mo-trol drive, known as Type H1, has been announced. Furnished in ratings through $\frac{1}{2}$ hp., the drive utilizes a simplified half-wave circuit to provide d-c flexibility from a-c power. Drive operates from 220 volt, 60 cycle a-c. It has a 20 to 1 speed range from 1725 to 86 rpm. It is furnished in either the non-reversing or reversing type, the latter being equipped with a separate magnetic reversing switch. Designed for constant-torque loads, under normal conditions the new drive has speed regulation from no load to full load. Speed may be preset, or may be varied during operation and under load. Dynamic braking permits quick stopping. Electronic panel is mounted in a ventilated NEMA Type 1 enclosure. General Electric Company, Schenectady 5, N. Y.

Intercom Circuit

A new intercom circuit which makes it possible to answer paged messages from high noise level areas has been introduced. This new circuit combines the coordinated operation of a Trumpet type paging reproducer and two-way staff station for use in either intercommunication or sound systems. When the system is used to page a person in one of the high noise level areas, the page message is reproduced at high volume through the Trumpet station.



When installing
mercury lighting

You Save 4 Ways

with G-E Tulamp
ballasts

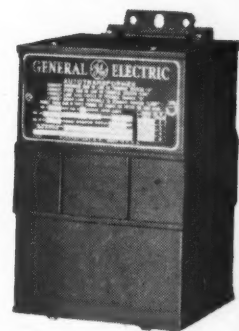
Tulamp ballasts combine the ballasts for two mercury lamps into one compact unit. This means: number of ballasts is cut in half—power factor is raised above 90 per cent by inherent design—stroboscopic effect is virtually eliminated. It means, when you install mercury-vapor lighting with these ballasts, you save four ways:

Save on Ballasts—A G-E Tulamp ballast costs less than a pair of single-lamp ballasts.

Save on Power—Losses are lower because the tulamp circuit is more efficient.

Save on Copper—Because of high-power-factor operation and lower starting current, smaller wire sizes can be used.

Save on Installation—Using Tulamp ballasts, only half the number of ballasts need be installed; smaller switches and fuses can be used; and installation is further simplified by carrying a common ground through to each pair of lamps.



Built by the largest manufacturer of Mercury H lamps, G-E Tulamp ballasts are designed for both H-1 400-watt and H-5 250-watt lamps. Single-lamp units—either uncorrected or high power factor—for operation of all standard lamps are also available. Contact your nearest G-E office or Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL  ELECTRIC

412-86

MULTI

INDUSTRIAL

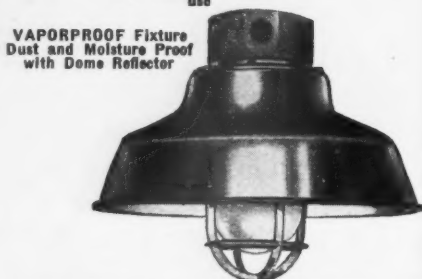
LIGHTING EQUIPMENT



STEEL REFLECTORS
Porcelain enamel



OUTDOOR
BRACKET FIXTURES
Low-cost unit for utility
use



VAPORPROOF Fixture
Dust and Moisture Proof
with Dome Reflector

*Better Lighting Units
mean More Jobs . . .
More Money*

The trend is toward better looking installations . . . you can get just about any effect you please AND good lighting efficiency too with MULTI Units. Each unit has a specific need and will give a maximum of service with a minimum of maintenance. There's a two-fold advantage in using the MULTI line—good looks—good pay!

MULTI ELECTRICAL MANUFACTURING CO.
4223 W. Lake Street Chicago 24, Illinois

To reply, the person called depresses a lever on the nearest conveniently located Staff Station. The Trumpet is automatically cut out and two-way conversation at normal voice level can be carried on between the person paged and the originator of the call. The Trumpet Reproducer, constructed of heavy gauge spun aluminum, is 10½ inches in diameter and in overall length, and is equipped with an adjustable mounting bracket. The metal Staff station, designed for mounting on wall or partition, is 6 in. wide, 6½ in. high and 3½ in. deep. These stations can be wired directly to any intercom or sound system. Exacutone, Inc., 415 Lexington Avenue, New York 17.

Magnetic Starter

These new solenoid-operated starters are intended for use in general and special purpose applications where across-the-line, non-reversing starting of polyphase squirrel cage induction motors and single phase motors is permissible. Starters are available with open type construction for built-in or specialized controls, or with NEMA type I general purpose enclosures. Starters can be controlled by separate pilot devices or can be supplied with local pushbuttons or selector switches. Some of the features include: high arc interruption capacity, compact unit construction, reliable thermal overload protection, built-in solderless connectors and double break silver-to-silver main contacts. Bulletin 4113 size 3 a-c magnetic starters have a maximum enclosed rating of 50 hp., 440-550 volts, 3 phase, 60 cycles. Standard operating coils can be supplied for 110, 208-220, 440 and 500 volt, 25 or 50-60 cycle service. Dual voltage coils can be furnished for 110/220 or 220/440 volt, 60 cycle operation. Ward Leonard Electric Co., Mount Vernon, N. Y.

Dust Collector

Model 20N30 Dustkop is the designation of a new self-contained, portable 2300 cfm. dust collector designed for handling dusts and dirt or toxic fumes separately or in combination from various types of cutting, grinding and other machining. Unit employs a direct connection from the outlet of the cyclone separator to out-of-doors. Units are available with a variety of standard sized inlets: optional sizes include single 7 in., single 6 in., double 5 in. or triple 4 in. Unit consists of a self-clearing paddle-wheel fan direct driven by a 3 hp. continuous duty motor which is equipped with motor starter switch. Installation of unit is

New **LIGHTWEIGHT ELECTRIC PLANT**

**5000
WATTS D.C.**



Model
5CK-115M, 5,000
watts, 115 volts D.C.

Weights only 315 lbs.!

Use fast-working electrical tools on any construction or maintenance job with this high capacity, portable, compact electric plant. Equipped with four-receptacle box for direct plug-in of tools or lights. Available with carrying frame, or dolly-mounted. Powered by Onan 10 HP, two-cylinder, 4-cycle, air-cooled engine. Shipped complete . . . ready to go!

NEW ONAN "CK" ELECTRIC PLANTS are available in 5000 watts D.C., 115 and 230 volts; 2000 and 3000 watts A.C. in all standard voltages. COMPLETE ELECTRIC PLANT LINE INCLUDES: A.C.—350 to 35,000 watts in all standard voltages and frequencies. D.C.—600 to 15,000 watts, 115 and 230 volts. Battery Chargers—500 to 6,000 watts, 6, 12, 24, 32 and 115 volts. ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5½ HP. 1B: 1-cylinder, 3¼ HP.

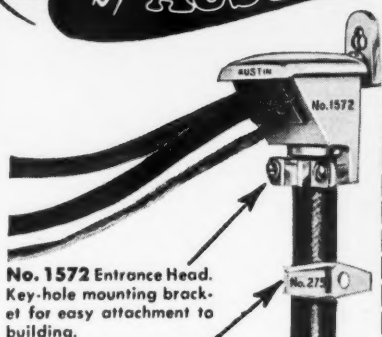


Write for catalog

D. W. ONAN & SONS INC.
3162 Royalston Ave., Minneapolis 5, Minn.

ONAN ELECTRIC PLANTS

ENTRANCE CAPS AND FITTINGS of Rustproof Cast Aluminum Alloy by **AUSTIN**

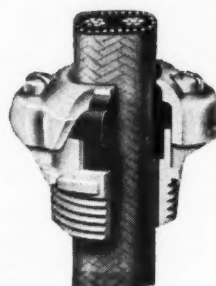


No. 1572 Entrance Head. Key-hole mounting bracket for easy attachment to building.

No. 275 One Hole Strap for oval-shaped cable.



No. 2275 Two Hole Strap for oval-shaped cable.



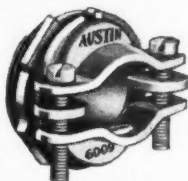
No. 50-36 Watertight Connector. Cutaway view illustrates how 3-point compression forces rubber gland around entire circumference of cable.



No. GR-1 Grounding Ring. For bonding meter box to artificial ground. Tight connection and positive bond without soldering.

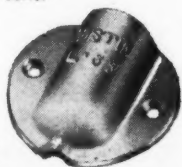
No. 6009

Non-watertight Connector. Takes a wide range of sizes and types of cable, round or oval, without the use of shims or inserts.



No. L-63

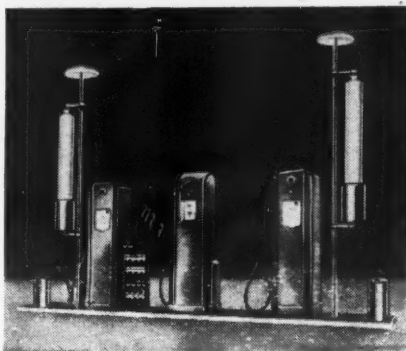
Sill Plate. Provides metallic protection to service entrance cable at the most hazardous point—where it enters the building.



SOLD THROUGH ELECTRICAL WHOLESALERS

The M. E. Austin Company
NORTHBROOK, ILLINOIS

made directly behind or near to the source of the dust with the starter circuit of the dust collector being interconnected with that of the motor of the equipment creating the dust. Floor size of complete unit is 22 by 40 in. Height overall is 56 inches. Agat-Detroit Co., 405 Ann Arbor, Mich.



Fluorescent Light

A new model four tube, 160 watt, Post-Lite has been added to this line of six tube, 240 watt and eight tube, 320 watt Post-Lites. Units are all-weather fluorescents especially engineered for outdoor lighting. The new four tube post-lite is available with or without brackets, cord and plug for easy installation on present posts, building walls and corners of buildings. Approximately 9200 lumens. Globes are round. W. H. Long Company, 61 W. Hubbard St., Chicago 10, Ill.

Voltage Tester

Announcement has been made of two new voltage testers, one designed for high frequency alternating systems and the other for the new low voltage systems. The high frequency tester operates on systems ranging from 110, 220, 330, 440 to 550 volts a-c; 400 cycles and 30, 60, 90 and 120 volts d-c. The low voltage tester is designed for systems ranging from 12, 24, 36, 48 and 60 volts a-c; 60 cycles to 10, 20, 30 and 40 volts d-c. A new style rubber lead protector replaces the old style spring guard for the test leads. Square D Company, 6060 Rivard Street, Detroit 11, Mich.

Luminaire

A new luminaire designed to distribute light from large mercury and incandescent lamps with a minimum of glare has been announced. Designated as Form 109, it is available in a wide variety of mountings, including slip fitter type in 1½ inch and 2 inch

Sherman High Strength Bronze Service Connectors



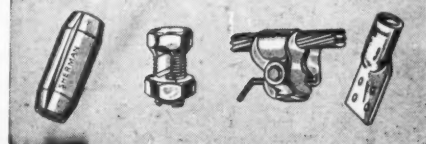
Sherman Connectors are made from silicon bronze averaging more than 90,000 lb. tensile strength per square inch. Threads on the body are not pressed or stamped, but are die cut and checked with precision gauges to mate perfectly with the tapped threads in the nut.

All connectors have full hex heads and nuts are extra thick. The solid, reinforced spacers provide maximum bearing surface on the wire and nut. Extra long pilot, for easy assembly.

Write today for Trade Bulletin 22 giving full data!

H. B. SHERMAN Mfg. Co.,
Battle Creek, Michigan

Sherman
ELECTRICAL
FITTINGS





DRILLING TIME CUT 76% with KETT TALL REACH BORER



"... an electrician ... cannot afford to be without this tool," says the Frey Electric Co., Cincinnati, after "on-the-job" tests with KETT Borer. In one test, twelve joists were bored with hand brace and bit and ladder; time per hole, 21 seconds. With the "Tall Reach" Borer, time: 5 seconds per hole. A 4½ hour hand job drilled in 1½ hours. This user states that other savings include: easy mobility over house-building debris, absence of fatigue, no wasted "waiting time" for master electrician and ease with which trainees learn correct hole boring.

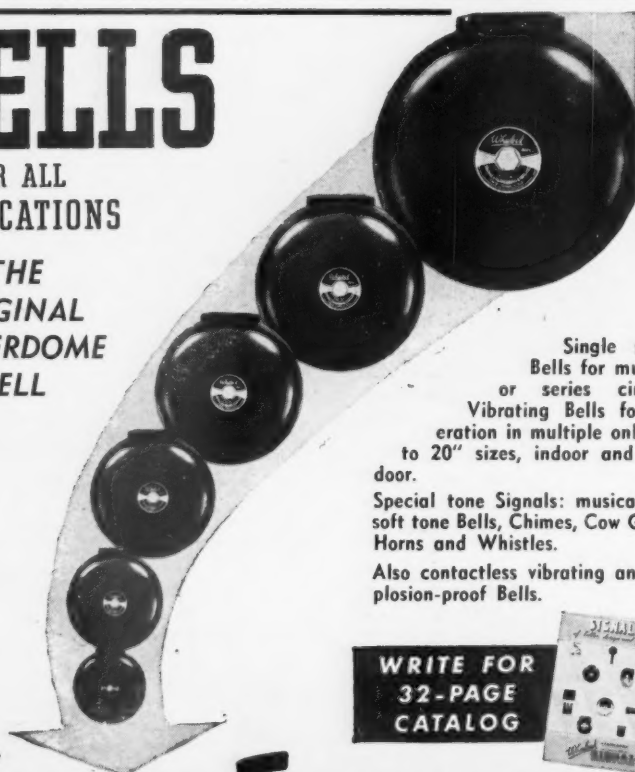
See your distributor or write for Bulletin F-2

The KETT Tool Company
5 EAST THIRD ST. CINCINNATI 2, O.

BELLS

FOR ALL
APPLICATIONS

THE
ORIGINAL
UNDERDOME
BELL



Single stroke
Bells for multiple
or series circuits.
Vibrating Bells for op-
eration in multiple only. 4"
to 20" sizes, indoor and out-
door.

Special tone Signals: musical and
soft tone Bells, Chimes, Cow Gongs,
Horns and Whistles.

Also contactless vibrating and ex-
plosion-proof Bells.

WRITE FOR
32-PAGE
CATALOG



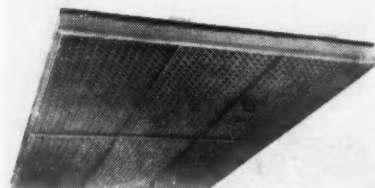
SIGNAL ENGINEERING

and MANUFACTURING COMPANY

154 WEST 14th ST.

NEW YORK 11, N. Y.

sizes. It will accommodate the 16,000 lumen Type FH-1 and 21,000-lumen Type EH-1 mercury lamps in a horizontal position or the 7 inch and 9½ inch center filament lamps. Reflector is hinged for relamping. For top-tapped mounting, an adaptor is available which permits use of Form 109 optical system with the standard Form 106, 101 and 79 hoods. Use of this adapter enables the changeover to filament lamps and the 109 optical assembly to be made directly, while conversion to horizontal burning mercury involves a substitution of a pair of long binding posts for present socket arrangement. General Electric Co., Schenectady 5, N. Y.



Fluorescent Lighting

A new fluorescent luminaire called the Panelux has been announced. Units are made in four sizes, 12 inch by 8 ft., 16 in. by 8 ft., 2 ft. by 8 ft. and 4 ft. by 8 ft. They can be used individually or in combination, joined end-to-end or side-by-side. They can be surface or pendant mounted or inset level with ceiling or false ceiling. By combining units of various sizes, it is possible to develop complete louvered ceilings or large louvered panels. Each unit is a complete luminaire, containing wiring channel, ballast housing and sockets in a chassis that supports louver sections. Louvers are made of white fire-resistant fibre-board and come in pastel shades. They carry two, four, six or eight 96 inch Slimline lamps at 120 ma, 200 ma or 300 ma. Lighting Products, Inc., Highland Park, Ill.

X-Ray Film Illuminator

Type "EFUX" explosion-proof X-Ray film illuminator is designed for flush mounting in hospital operating rooms. It includes an explosion-proof switch which eliminates the need of an additional switch Unilet. Handle extends through upper part of panel within convenient reach of operator. Four chrome plate roller clips at top of glass are provided to hold the film. Two extended hinge clips are furnished to support the wet film holder. A drip tray may be used and adapted to the two lower clips which hold glass panel.

Revolutionary, New

Roto!

CLEANS • PRESERVES
POLISHES

ALL

ELECTRICAL CONTACTS

Commutators, Slip Rings, Contact Tracks, Controllers, Starters & Regulators, Relays, Cell Switches, etc.

Roto!

Thoroughly dissolves dirt and waste . . . Is easy to use . . . Acts quickly.

Roto!

Is Safe . . . It is non-inflammable and does not give off any poisonous fumes.

Roto!

Is self-sufficient. No sandpaper or other abrasive necessary.

Roto!

Leaves no residue or film . . . assures clean contact.

Roto!

Is economical. A small quantity cleans a large motor.

\$1.10 per pint can
\$7.92 per gallon

If not available from your supplier, order direct.

NOTE TO DISTRIBUTORS

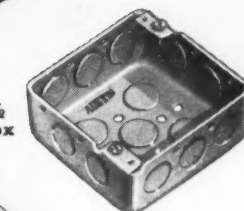
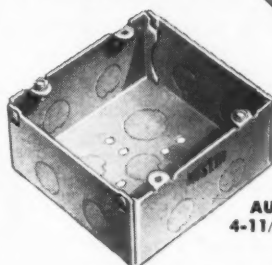
Some Choice territories still open.
Write for details.

Roto!

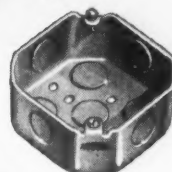
CHEMICAL CORPORATION
315 Fifth Avenue—New York 16, N. Y.

A COMPLETE LINE OF
AUSTIN
OUTLET BOXES, CABLE
BOXES, EXTENSION
RINGS AND COVERS

AUSTIN No. 300-1/2
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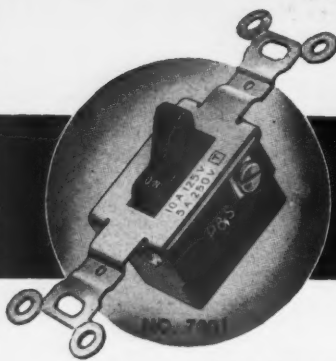
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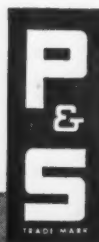
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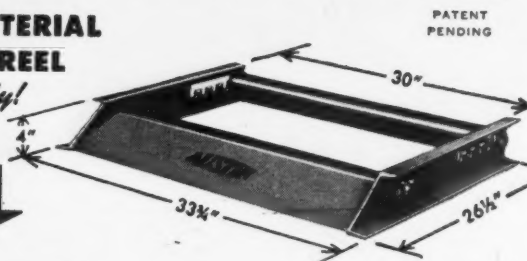
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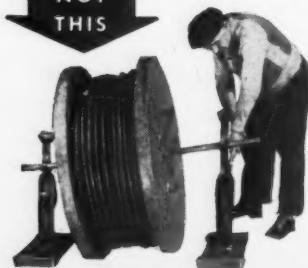
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3144

A threaded hub for $\frac{1}{2}$ inch rigid conduit is provided in bottom of cabinet. When installing, metal cabinet should first be flush mounted in the wall. The fixture is mounted in the cabinet. Line wires are connected to the connection block located under screw cover in lower housing. It uses two 15 watt T-12 fluorescent lamps and furnished with 110-125 volts, 60 cycle ballast. Appleton Electric Company, 1701-59 Wellington Avenue, Chicago 13, Ill.

Fluorescent Fixture

A new over-all fluorescent office lighting fixture known as "Leaderall Louvered Light Ceiling" has been developed. Fixture is of moulded de-staticized plastic. Units can be expanded endlessly. Tie-rods of various lengths are available so that the illuminated "ceiling" can be of any height below the structural ceiling to which the lamps are attached. Weight is reduced as units are of plastic. Leader Electric Co., 3500 N. Kedzie Ave., Chicago 18, Ill.

Low Voltage Controllers

A new line of low voltage controllers for use with a-c motors up to 800 hp. at 550 volts, and for d-c motors up to 350 hp. at 230 volts, has been announced. These metal-enclosed controllers are designed for controlling squirrel-cage, wound-rotor, synchronous, or multi-speed a-c motors, or d-c motors. They include in one unit not only the conventional equipment required to start, stop, and control such motors, but in addition a completely integrated draw-out air circuit breaker which provides short-circuit protection. Serving also as a circuit isolating device, this draw-out breaker is designed so that it is interchangeable. General Electric Co., Schenectady, N. Y.

Alternators

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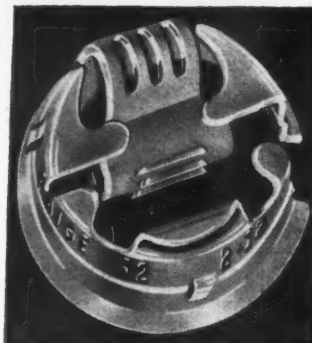
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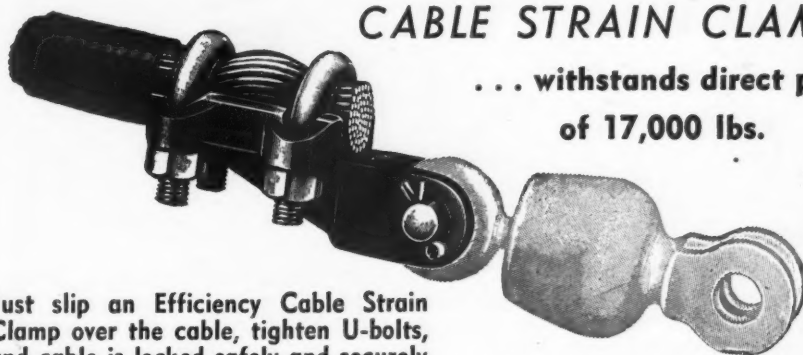
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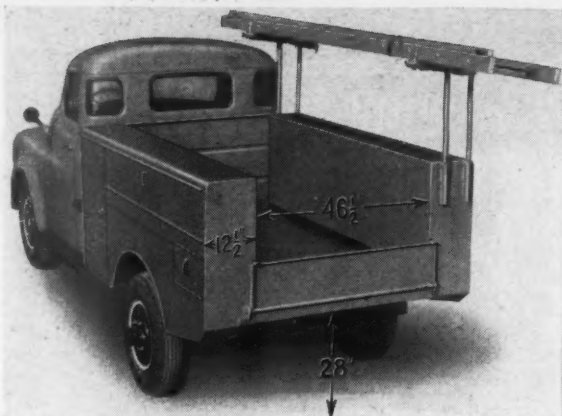
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New Equipment Briefs

Belle City Glove Co., Chicago, Ill. has announced the development of a new plastic coated and impregnated glove, known as "Plastigluv", with a cotton fabric base. . . . Combustion Control Corporation, Cambridge, Mass. has announced a new photoelectric flame failure safeguard system for supervising both the pilot gas flame and the main oil flame of fully automatic oil burners. . . . A new d-c voltage multiplier for the Sylvania Polymeter, which extends d-c voltage measurements to 10,000 volts, has been announced by the Radio Tube Division of Sylvania Electric Products, Inc., New York, N. Y.

A heavy duty portable electric drill, designed to stand up to full industrial loading, has been made available by S. Wolf and Company, Ltd., London, U. S. representative, Fred L. Stuart, New York, N. Y. . . . A new type of self-adhesive wire marker has been introduced by the Flag-It Wire Marker Co., Los Angeles, Calif. . . . Bi-Seal, a new self-bonding electrical insulating tape has been announced by the Bishop Gutta Percha Company, New York, N. Y. . . .

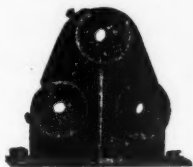
A new and improved rotary concrete drill has been developed by the Tilden Tool Mfg. Co., Pasadena, Calif. . . . A fluorescent lamp and starter tester device designed to reduce the cost of operating fluorescent lighting fixtures and to prevent waste of good lamps is being manufactured by Compco Corp., Chicago, Ill. . . . A self-energized magnetic drum requiring no electric current to produce a magnetic field has been announced by the Eriez Manufacturing Co., Erie, Pa.

Westinghouse Electric Corp., Pittsburgh, Pa. has developed a new type ASR relay providing simpler starting of synchronous motors. . . . A new plastic tubing, approved by Underwriters' Laboratories, Inc. for continuous use at temperatures up to 105° C, has been announced by Irvington Var-nish & Insulator Company, Irvington, N. J. . . . Wright Hoist Division of American Chain & Cable Company, Inc., has developed a new series of Wright Speedway electric hoists.

Industrial step ladders made of special alloy duraluminum and incorporating safety features are being manufactured by the Safe-Tee-Step Company of Maplewood, N. J. . . . Empire Development Corp., New York, N. Y. has developed the "DRAW-IN-DEX" cabinet for filing blueprints safely and conveniently without wrinkles, creases or curled edges. . . . S & C Electric Company, Chicago, has extended its line of Alduti interrupter switches to include 23,000 and 34,500 volt ratings.

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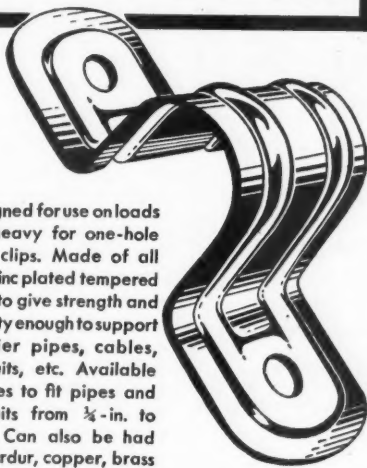
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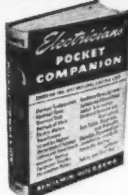
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[FROM PAGE 85]

1. Upon the initiative of the Correlating Committee after a four or five-year interval since a previous General Revision.

2. After a shorter interval upon the request of the publishers of the Code.

Code-Making Panels

A Code-Making Panel has referred to it; considers, and reports as to its recommendations proposed amendments or revisions of the National Electrical Code. Each Panel has sponsorship of one or more related Articles of the Code.

It will be the responsibility of the Correlating Committee to provide for proper representation on the various Panels of those concerned with their respective Article assignments.

The number of Code-Making Panels and the Code Articles assigned to each shall be determined by the Correlating Committee which shall also appoint the Chairman of each Panel and the individuals formally designated to serve with him. It shall also designate alternates for such individuals when conditions seem to warrant. Groups concerned with the Articles handled by a Panel may designate a representative to serve.

Additional personnel (and alternates) may be added by the Correlating Committee following its consideration of nominations from groups that are concerned. The Correlating Committee does not expect that every group will require representation on every Code-Making Panel.

The program of each Code-Making Panel shall be directed by its Chairman as seems most appropriate for efficient disposal of the suggested revisions of the one or more Articles that are assigned to it.

Each Panel may develop its own working methods, subject to the requirement that its recommended revisions of the National Electrical Code must represent, in a major degree, the consensus of those substantially concerned with the Code Article by which the recommendations are recorded.

Technical subcommittees to consider any designated topic shall be appointed by the Chairman of the National Electrical Code Committee, if directed by the Correlating Committee or upon his own initiative. Those invited to serve on a technical subcommittee shall be chosen on the basis of

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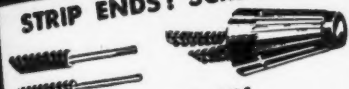
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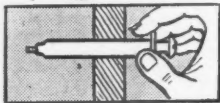
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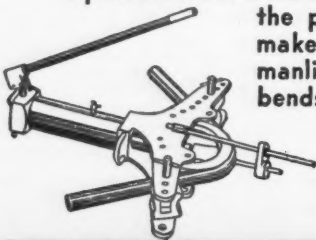
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to any desired angle



without moving pipe



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Attachment — for
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familiarity with the problem or topic and need not be members of the National Electrical Code Committee. Its report, if containing proposals for changes or additions to the National Electrical Code, shall be referred to that Code-Making Panel to which the affected Article of the Code has been assigned and, if approved, shall be submitted to the Correlating Committee for further processing.

It is expected that the various Panels will each solicit from individuals or groups concerned with the scope of an Article the technical assistance and co-operation that will contribute to having its recommendations represent a consensus. Those co-operating in this manner shall have mention in the report of the Panel.

When reporting recommended revisions, the outcome of voting by the designated members of a Panel shall be recorded with the Correlating Committee by the Chairman of the Panel. This report shall advise respectively as to the number (of designated members) voting in favor or against and also those formally refraining from voting; if requested by a member, his reasons for an affirmative or negative vote or for refraining from voting shall be included in the report. The required voting record shall not include the individuals serving without having been formally appointed to membership in the Panel.

Each Panel shall report also its having given consideration to any proposals for Code changes that have been referred to it and which are not recommended.

Method for Handling Proposed Revisions

The stages through which proposed changes in the Code are to be considered will be as follows:

1. Proposal is prepared by some person and is assigned to a Panel.
2. Panel considers and forwards to the Correlating Committee.
 - 2a. Panel may refer it to a subcommittee for recommendation.
3. Correlating Committee submits revisions to Electrical Section.
4. Electrical Section approves or returns it to Correlating Committee.
5. Correlating Committee may make final check for correlation.
6. Revisions reported to NFPA annual meeting.
7. NFPA acts in annual meeting, and may refer to Board of Directors.
8. NFPA submits it to American Standards Association.

SEARCHLIGHT SECTION

(Classified Advertising)

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BUSINESS : USED OR RESALE**

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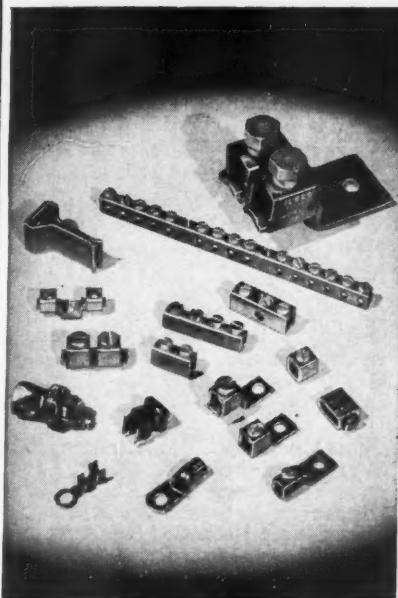
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"Give us the tools . . ."

McGraw-Hill Surveys

BUSINESS NEEDS

If it can get the money American industry in 1949 will go full steam ahead with a vitally-needed program of improving its facilities. This program since V-J Day has kept business expanding and has made belated headway in modernizing industry.

Furthermore, if it can get the money American industry will carry on for the next five years with its unprecedented program of expenditure for new plant and equipment. Plans already made call for spending about \$55 billion.

These are findings of the McGraw-Hill national survey of "Business' Needs for New Plants and Equipment." Major results of the survey, which have been rechecked since election day, are summarized on the following page. They report what American industry is now planning to spend for new plant and equipment. *They do not and cannot show what will be done if the plans are hamstrung by political action.*

In 1949, the survey shows, American industry plans to spend \$14.1 billion for new plants and equipment. That is only about 5% less than was actually spent in 1948.

If these plans are carried out, actual capital expenditures this year may be somewhat larger than they were in 1948. That is because expenditures usually prove to be larger than planned.

Fulfillment of American industry's plans for investment in new plant and equipment this year would no doubt mean a continuation of general prosperity. The record shows that when capital expenditures are high general business thrives.

Even more remarkable than the 1949 prospect is the fact that:

Industry already plans to spend \$41 billion in the years 1950-53 to improve its plants and equipment.

Plans tend to taper off, of course, as they are pushed further into the uncertain future, five years from now. But the striking fact is that plans for expenditures so far ahead are as great as they are. They show American in-

dustry's need for tremendous improvements in its plants and equipment.

Again, let there be no mistake. These survey findings are not a five-year forecast. They report what leading corporations now are planning to do — *if they can get the money.*

But — won't industry be top-heavy with plants and equipment if it carries through any such program?

The answer is clearly — "No".

Here are some of the reasons why not that were disclosed by the McGraw-Hill survey:

First, manufacturing industries are shifting emphasis from expansion to improving efficiency.

They have increased their total capacity 56% since 1939. Their expenditures in 1948 went almost 50-50 for expansion and improvement. But in the next five years they plan to spend three-quarters of their funds to replace and modernize facilities, only one-quarter for expansion.

Second, the prospective rate of expenditure for new plant and equipment is relatively low.

Planned expenditures for new plant and equipment in 1949 represent about 7.5% of the present value of all plant and equipment. That rate of capital expenditure is no higher than the rate during previous periods of prosperity. And industry must overcome years of starvation for new equipment, caused first by the depression of the 30's, then by diversion to war production.

Third, industry is following an extremely cautious policy in buying new equipment.

Three out of four companies report that they will not buy equipment unless it will pay for itself within five years. And a third of the companies report that they expect new equipment to pay for itself within three years. The reason most frequently given for such expectations was that all the money available can be spent on equipment which does pay for itself quickly.

The program of capital expenditure planned by American industry is one of the greatest bargains ever offered to the American people.

To pay for itself in a few years, as equipment must if most companies are to consider buying it, that equipment

continued on next page

WHAT THE SURVEY SHOWS

● HERE ARE THE MAJOR FINDINGS of McGraw-Hill's survey of "Business' Needs for New Plants and Equipment". Rechecked since Election Day, results show what industry is now *planning* to spend for new plants and equipment. They do not forecast what will actually be spent. The survey shows:

1. Industry now plans to spend \$14.1 billion in 1949—and almost \$41 billion in the four years beyond, 1950-53.
2. Manufacturing industries alone plan to spend \$7.2 billion in 1949. This is 7.5% of the estimated value—\$96 billion—of all manufacturing facilities.
3. Manufacturers estimate conservatively that it would cost \$136 billion to completely replace their facilities with the most modern plants and equipment available.
4. Postwar expansion is virtually complete in most manufacturing lines. Major exceptions: steel and petroleum refining.
5. Expansion programs of railroads, utilities, and oil companies still have two to five years to run.
6. Manufacturing industries have increased their capacity 56% since 1939. But expansion is slowing down. Increase planned in the next five years is only 13%.
7. Efficiency is emphasized more and more in planning new facilities. Manufacturers plan to devote almost three-quarters of their funds to replace and modernize. In 1948, 58% went to increase efficiency this way.
8. Equipment should pay for itself in five years or less, say three out of four manufacturing companies. New buildings, say 77% of them, should pay out in 15 years or less.
9. Profits and reserves are counted on to pay for new buildings and equipment by three out of four manufacturing companies. Some 15% expect to borrow, only 9% plan to sell stock. However, 20% would like to sell stock, only 4% want to borrow.
10. More liberal depreciation allowances for income tax purposes would prompt almost two-thirds of the companies to speed their purchase of new plants and equipment.

● A copy of a complete report on "Business' Needs for New Plants and Equipment" may be obtained by writing me at McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y.

must promise to produce much better products or make great savings in labor and material. The savings go first to the companies buying the equipment but, as they always have, they soon spread to everyone in the form of better products at lower costs.

Where does industry expect to get the money to buy this bargain for the American people?

Most of the companies covered by the McGraw-Hill survey (76% of the total) count on their own resources—largely profits—to pay for new plant and equipment. About 15% of them expect to borrow money, although only 4% like the idea of getting saddled with fixed debt. Only 9% of the companies expect to sell stock to investors, although twice that many report they wish they could.

What are the chances that business can get the money?

The survey provides no answer to that question. No survey can.

The answer will come from Washington—in what Congress does about taxes on profits and taxes on the millions of Americans who might invest a part of their income in industry's new plants and equipment.

The answer will be found also in the energy and skill shown by investment bankers, particularly in mobilizing the resources of the millions of Americans whose incomes have increased enough since 1940 to make them potential direct investors in industry.

Still another important part of the answer will be given by labor leaders. About half the companies surveyed by McGraw-Hill are holding back on new construction—primarily because of high costs. What organized labor does about wages and productivity can swell or shrink that percentage.

The McGraw-Hill survey leaves no doubt that Ameri-

can industry is fulfilling its responsibility. It is planning the capital improvements needed to make the nation secure, prosperous, and progressive.

But business today lacks confidence and badly needs added incentives. Proper taxation and increased depreciation allowances are vital if we are to open the capital markets to finance industry.

What will happen now depends in large part on what is done in Washington. In his State of the Union message, the President said that "business should plan for steady, vigorous expansion." But in his budget message he proposed new taxes which would divert a substantial share of the money industry is using for expansion and improvement. Moreover, he said nothing about the vital issues now freezing the capital markets.

It is not possible to have it both ways. Fulfillment of the President's tax program means cutting industry's program for new and better equipment. It means slowing down industrial progress. It means delaying the advance toward much higher standards of living tomorrow in order to have a little more government spending today.

I urge you to see that your Representative and your Senator have all the facts on industry's needs for new plant and equipment. What they do to this program will have a decisive bearing on the nation's security and welfare.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This is the fourth editorial of a special series on industry's needs for new plants and equipment—and what these needs mean to all Americans.